the OIL AND GAS JOURNAL

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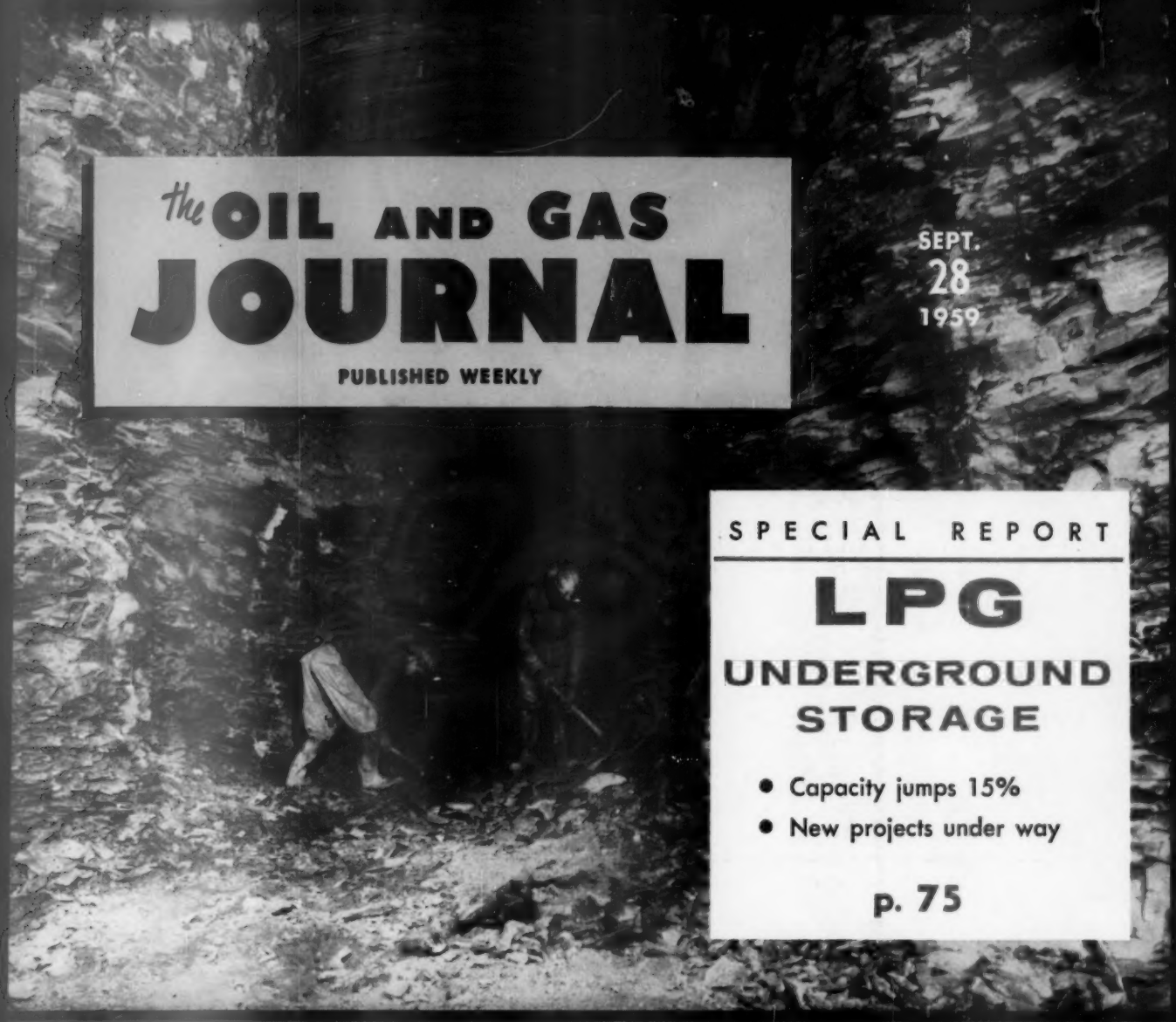

SPECIAL REPORT

LPG UNDERGROUND STORAGE

- Capacity jumps 15%
- New projects under way

p. 75

Opposition forms to Oklahoma 50-bbl. minimum ▸ 43

What the 4-cc. TEL limit means to refiners ▸ 46

Shell building fewer, but bigger, service stations ▸ 48

Why the Skelly-Tidewater merger fell apart ▸ 50

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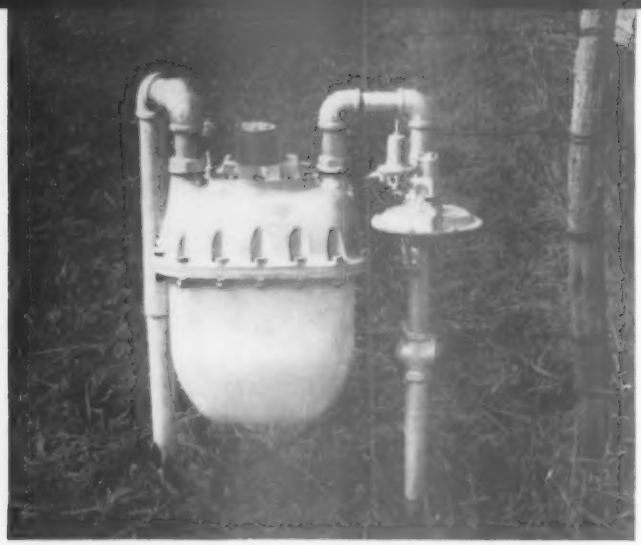
It's portable, It's corrosion-resistant

It's the ROCKWELL "1600" ALUMINUM GAS METER

for measuring field gas at up to 100 psi working pressure



Rockwell "1600" meter with Rockwell "173" regulator (pilot loaded), on field service in Texas.

The Rockwell "1600" is tailored to the job of measuring gas sold or used on the lease. It weighs only 63 lbs., so one man can easily carry and install it. The sturdy aluminum outer case withstands weathering and takes bumps and knocks in stride. There's a generous capacity rating of 1600 cfh at 4 oz. inlet pressure. This capacity can be materially increased by measuring gas at higher pressures . . . up to 100 psi. Corrections to base pressure for volumes measured at higher pressures can be made by equipping this meter with either a Rockwell Emcorector or a Combined Record Gauge. Write for full details to Rockwell Manufacturing Company, Pittsburgh 8, Pa.

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OIL AND GAS JOURNAL
Vol. 57 No. 40

Contents September 28, 1959

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Annual index available on request.

TECHNOLOGY—OPERATION

Refining-Processing

LPG Underground Storage Capacity Hits 49,024,000 Bbl. 75

By Robert B. Bizal

This underground storage capacity in the U. S. includes projects which are currently under way and scheduled for completion within a year. This is an increase of 15% since last year and three times greater than the 1955 capacity. This annual Journal survey details the various projects by state, company, type of storage, and production. The survey also points up a number of new projects which are under way.

How Humble Rates Its Gas Turbine 88

By Charles Bultzo

The 5,000-hp. gas turbine in use at Humble Oil & Refining Co.'s Baytown refinery has proven highly satisfactory. The equipment is a simple-cycle, two-shaft gas turbine. It drives a high-capacity centrifugal blower supplying regenerator air to a fluid catalytic cracking unit. Axial-compressor and axial-compressor-turbine efficiencies have been below par. A plan has been worked out for work to be done during the next down time that should result in improved efficiency.

Process Costimating—57 96

Complexity of refinery versus manpower. The number of productive workmen ranges from 99 to 545 men per 10,000-bbl. per day capacity. Most of the variation is caused by differences in the complexity of the refinery operation.

Drilling

Let's Return to Central Power Plants 79

By W. S. Crake

This is a necessary move to simplify and cheapen machinery moving, rigup, and maintenance. Only two complete solutions are visible for the transmission problem as a "plug-in" power plant: the a.c. torque converter and the d.c. ring. The technical problem of paralleling generators and of motor starting can now be solved. A full-sized portion of an a.c. converter rig has been purchased in Holland for field proving.

Pipelining

Proving Systems for P.D. Meters 100

By R. H. Pfrehm

Design of a meter-proving system should allow operation without having to remove the meter from service and without stopping it. Acceleration and deceleration of the meter present in a stop-start calibration places a portion of the calibration run in the low-volume area of the curve where slope is greatest, thus introducing inaccuracy in the meter factor determined.

Pipeline Construction Report 115

Production

Heavy Crude Is More Attractive Now 105

By E. W. Walker

Reasons are (1) new developments in heating oil in reservoir; (2) improved pumping methods; (3) better treating facilities and procedures; and (4) better approach to shipping problems. The rod pump has proved the most common lifting method. The proper application of equipment, the right selection of facilities, the utilization of waste heat, the use of insulation, and the selection of good operating techniques can result in operating savings and lower production costs for years to come.

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Sept. 28, 1959

IPAA prediction of demand upturn is good news.

Domestic market for crude is expected to reach 7,250,000 bbl. daily by end of year.

This is 200,000 bbl. daily above actual production in last quarter of 1958 and 450,000 bbl. daily higher than depressed rate of production this month.

One note of caution in report: Increased seasonal demand will not require jump in refinery crude runs.

Heavy crude runs in June-August period have resulted in excessive product inventories. IPAA says if runs in fourth quarter are kept to 8,000,000-bbl. daily average, balance will be restored to crude-product inventory ratio.

▼ ▼ ▼

Excessive product stocks actually led Texas Railroad Commission to retain 9-day allowable for October (p. 64).

This means several major buyers will have to scramble for supplies.

Spokesman for independents at Austin hearing apparently expressed commission feeling too. He said only way to control refinery vice presidents is to keep crude away from them.

Crude price notes: California crude will get a less severe price cut than at first thought. California Standard's 5 to 25-cent cuts are being preferred to Union's 10 to 50-cent slash. Joining Standard are General Petroleum, Richfield, and Texaco...Shell now is joining the 15-cent cut for Four Corners crude.

Humble last week began importing residual fuel oil from Aruba at its Baytown docks for the first time in many years.

Humble says there is a domestic shortage of residual. It will import about 8,200 bbl. daily through October to meet its customers' requirements.

▼ ▼ ▼

Foreign engineers working for oil companies in Venezuela will be allowed to practice their profession until next year.

What happens then depends on how a law is enforced

ordering the degrees or engineering certificates of foreigners revalidated by a Venezuelan board.

The engineers association of Venezuela is negotiating with the oil companies on a satisfactory compromise. The agreement, however, is expected to contain a clause permitting Venezuelan engineers to hold important jobs in the engineering departments of oil firms there.

Iraq is finding Russian engineers no bargain.

The Kassem revolutionary regime has been making propaganda about great savings made at Daura refinery when American technicians were replaced by Iraqis and Russians.

Soviets admitted from first they couldn't operate a new Powerformer, completed last May and not yet put on stream. Now they want Kassem to send Iraqi engineers to the U. S. to learn to run the unit. Also Iraqis are finding they have to hire an expensive interpreter to accompany each Russian engineer.

▼ ▼ ▼

Explorationists will profit from a fine little story our Dr. Frank Gardner tells on p. 143. It's about an abandoned well, reworked and made to produce 22 years later.

The lesson is important: Value of new logging and interpretation tools and of surface geology.

Illinois has its most important hit in some time.

Wildcat in Williamson County, 6 miles northeast of Marion in southern part of producing area in Illinois basin, is apparent Cypress-Mississippian sand discovery. Well is Mutual Oil & Gas Madison "E".

Recovery on 3-hour test at 2,285-316 ft. was 540 ft. of gas, 150 ft. clean oil, 90 ft. mud-mixed oil, and no water. Core at 2,293-316 ft. got 18 ft. of saturated sand.

Well is south of Cottage Grove-Shawneetown fault and is 4 miles from any production.

Scouting some new plays:

Wyoming's Wind River basin hunters have a new target, the Lance formation, uppermost member of the Upper Cretaceous. California Co.'s 1 Waltman got 200 bbl. daily at a Natrona County wildcat.

New boom may come to the tristate region of Texas and Oklahoma panhandles and southwestern corner of Kansas. Deep drilling campaign in region is quietly looking at a pair of Permian rocks, the Tubbs sand and Council Grove (p. 144).

▼ ▼ ▼

Alaska has a new drilling-depth record.

Union and Ohio Oil's 1 Kenai is below 14,730 ft., breaking record held by Humble's Peninsula wildcat which

went to 14,374 ft. before stopping. Union and Ohio are drilling ahead on their important test.

Coastal Drilling has given no indication how deep the wildcat will be taken. Rig has capacity of 15,000 ft. Depth of 14,415 ft. was reached in 105 days with 4½-in. drill pipe being used. With 3½-in. pipe, depth could be carried on below 15,000 ft.

Location is on Kalifonsky Beach about 6½ miles south of Kenai town on east shore of Cook Inlet (p. 58).

John W. Mecom, Houston independent, is pulling out of Lake Washington field, Louisiana.

His reasons are familiar to all drilling men:

...Louisiana's per well allowable which has not been changed for 13 months.

...Uncertainty of markets.

...Low price of crude.

...High drilling costs.

Mecom is pulling five rigs out now, may ship them to Colombia where he has contract rigs on a 2.5-million acre concession. When present drilling and workover jobs are completed, the rest of Mecom equipment will leave.

▼ ▼ ▼

Air drilling is making some startling gains:

Well in Terrell County, Tex., is drilling below 17,000 ft., almost 3,000 ft. deeper than previous record.

Another well in same area was blown dry of mud in a single stage from 14,400 ft.

Air-drilling rates using hammer drill have been as much as six times higher than conventional air drilling.

Silicon tetraflouride gas treatment has succeeded in shutting off water in 75% of West Texas field trials (p. 61).

Electric rig drives cause a controversy.

Two factions appeared in camp of electric-drive proponents last week at ASME conference in Houston (p. 54).

One defends present d.c. equipment used almost universally on electrified American rigs.

Other proposes some radical changes involving use of squirrel-cage a.c. motors driving through torque converters.

▼ ▼ ▼

A pitch with reverse twist is being given to petroleum credit men. It's the "cash card" movement originating in the East.

Oil companies will be asked to join the movement. A card-promoting company sells the customer a "cash card" for $5 a year. The card entitles the holder to a 10% discount for cash at service stations, stores, and other businesses cooperating in the plan.

Idea is privately inspired but is being watched closely by oil marketers.

Shell is reducing the hazard of service-station operations by having fewer but bigger stations.

Study shows the chances are three times greater for a small station going broke as a big one. Shell uses these odds to cut down its dealer turnover which cost some companies in the industry as much as $1 million, (p. 48).

▼ ▼ ▼

New military specifications for jet fuels, grades JP-3, JP-4, and JP-5, are expected to be out this fall.

The new spec, MIL-J-5624E, will be changed only slightly from its predecessor. It will formally make the thermal stability test mandatory and may include a revision in the section on corrosion inhibitors, further limiting their use.

The thermal stability test has been in force since June 9 when suppliers were first notified.

Lifting the TEL barrier from 3 to 4 cc. per gallon won't mean a sudden spurt in use of lead (p. 46).

Most gasolines still are well under the old limit. The big result, however, will be to help some refiners keep pace in the octane race, especially the small and medium-sized.

LPG underground storage capacity has climbed to 49,024,000 bbl., counting projects now under construction.

That's 15% higher than last year and three times the 1955 capacity.

The Journal's sixth annual survey shows that 11 new projects are on the books (p. 75).

▼ ▼ ▼

The French are making a bold move to restore peace to war-torn Algeria, now important because of oil.

President De Gaulle has given Algerians the right of self determination. But if complete independence is picked, De Gaulle says operation of Saharan oil fields and handling and shipping the oil will remain in French control.

Hassi Messaoud oil is due to arrive on the Mediterranean coast within a few weeks through a new 397-mile pipeline.

Gas also is running into market resistance.

Imperial is using an unusual weapon to fight inroads of natural gas into its home fuel-oil market. It offers homeowners second mortgages at low interest. In return, mortgage takers naturally use Imperial's furnace oil.

Plan now is concentrated in British Columbia and Quebec, but may spread to Ontario.

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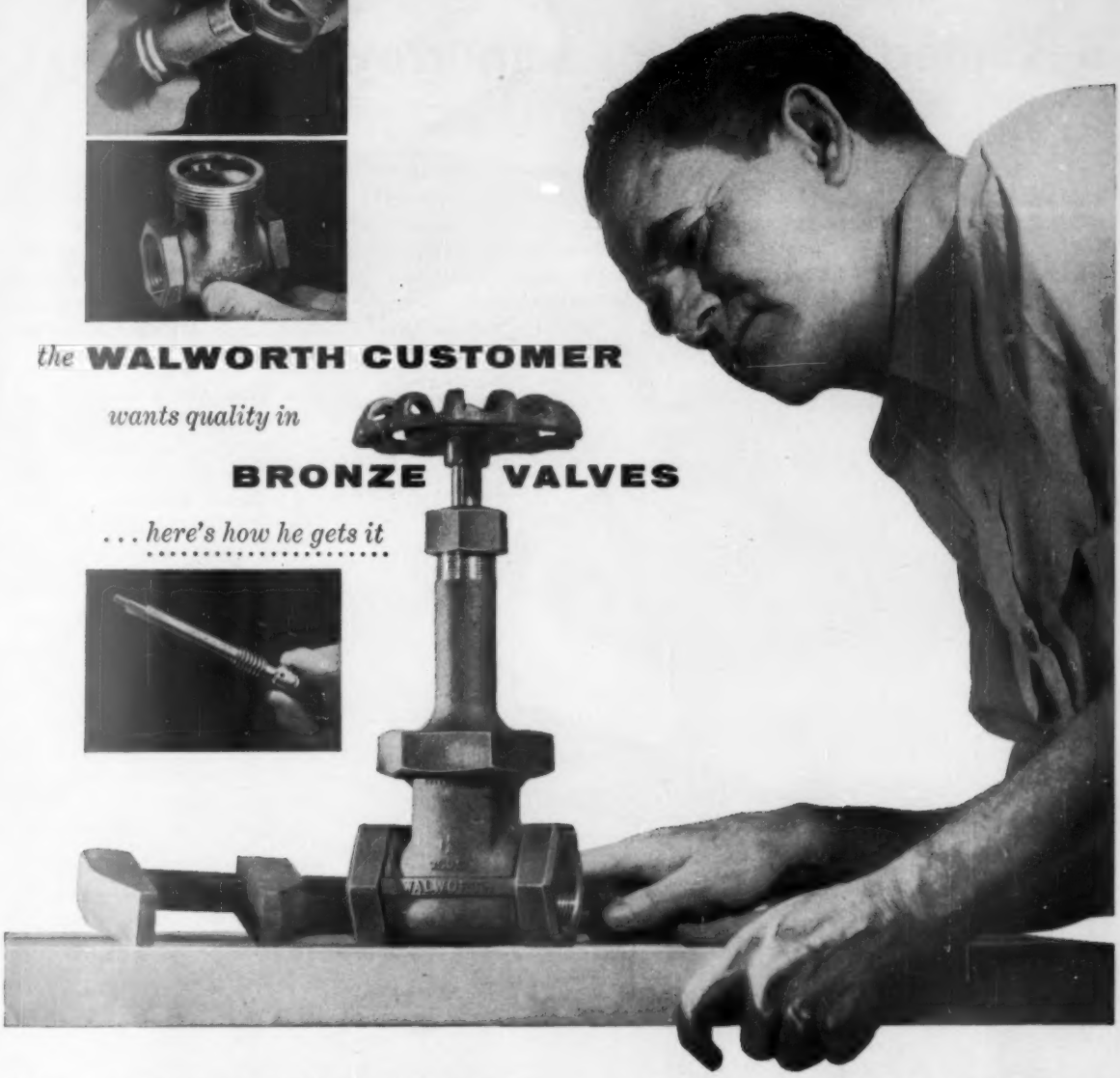

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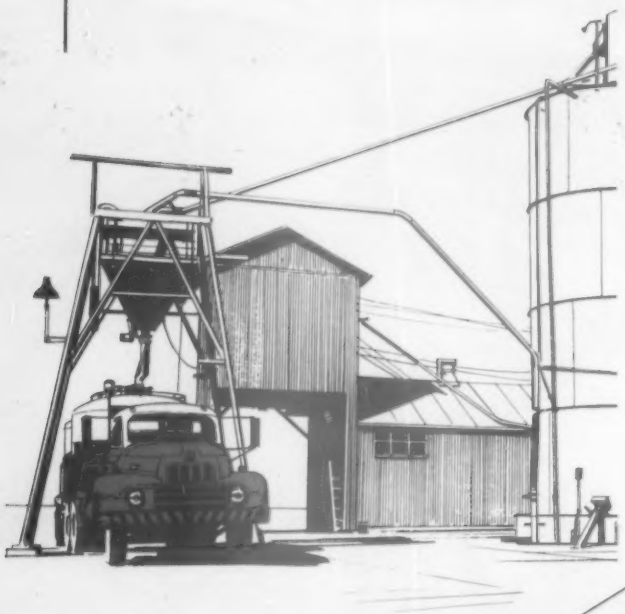

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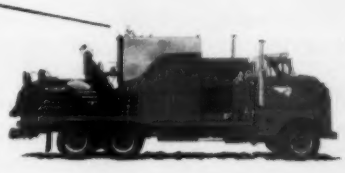

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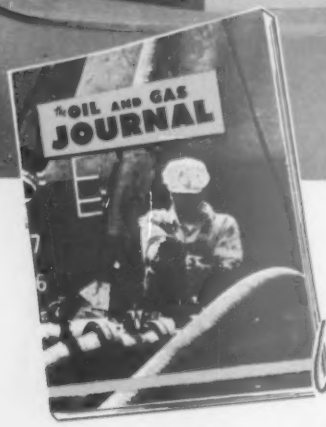

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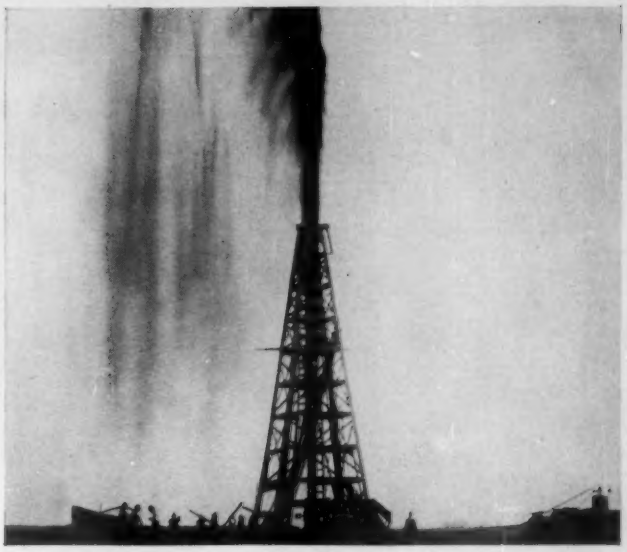

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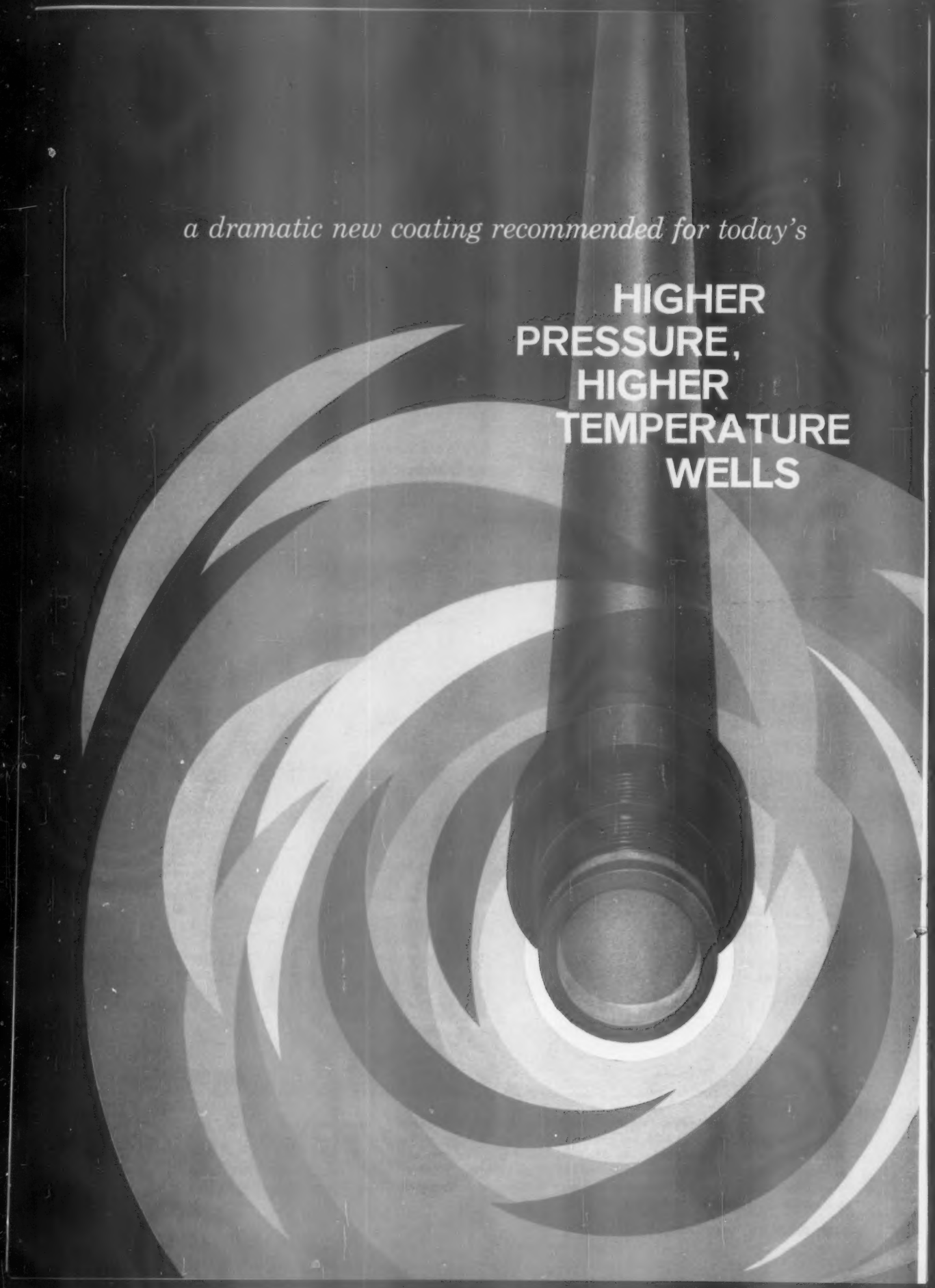
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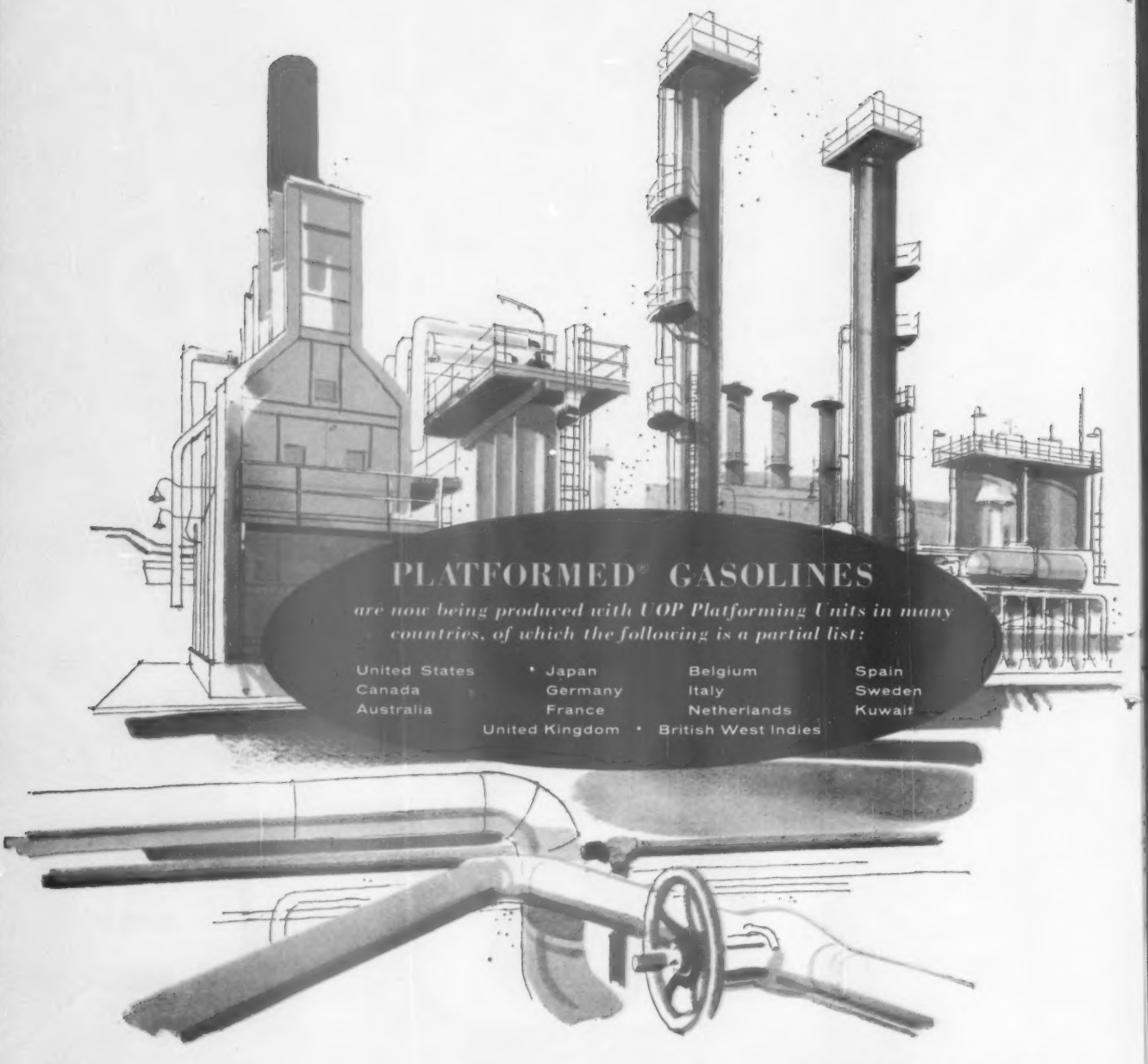

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Platformed® Gasolines

This year marks an important anniversary . . . the anniversary of an announcement that made significant history throughout the petroleum refining industry.

In March of 1949, Universal announced an important achievement in the field of catalytic reforming. In October of the same year, the first Platforming unit was placed in operation at a Muskegon, Michigan refinery. The new process, Platforming, literally revolutionized the entire concept of processing to improve motor fuels. It made previous methods of refining completely obsolete.

In addition to its value in producing superior Platformed gasolines, Platforming has also proved highly efficient in producing aromatic hydrocarbons, thereby providing the basis for the great petrochemical developments which have since taken place.

The rest of the story is a matter of history. Though many improvements and modifications have since been made, the same basic Platforming process has been applied by refiners throughout the Free World, and now accounts for a large proportion of all the reforming carried out today.

UOP®

UNIVERSAL OIL PRODUCTS COMPANY

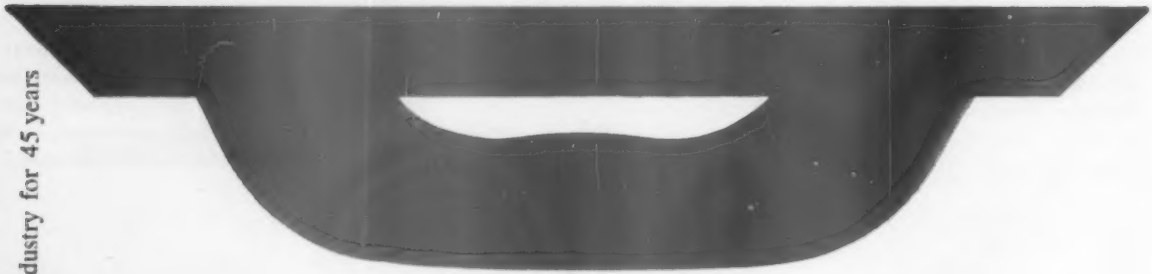
30 Algonquin Road, Des Plaines, Illinois, U.S.A.

First with Texas industry for 45 years

Austin F. Allen, Chairman of the Board Ben H. Mitchell, President Home Office: Dallas

The mortar which cements
any employer-employee
relationship is trust.
There is no more effective way of
increasing this trust than by providing
yourself and your employees with
the best possible workmen's
compensation insurance program, the kind of insurance
program which not only protects you but which offers
them fast, fair, efficient settling of every claim, safety
engineering to cut down on the possibility of accidents,
rehabilitation service in case of serious accident.
So always build with the best; see your TEIA man.

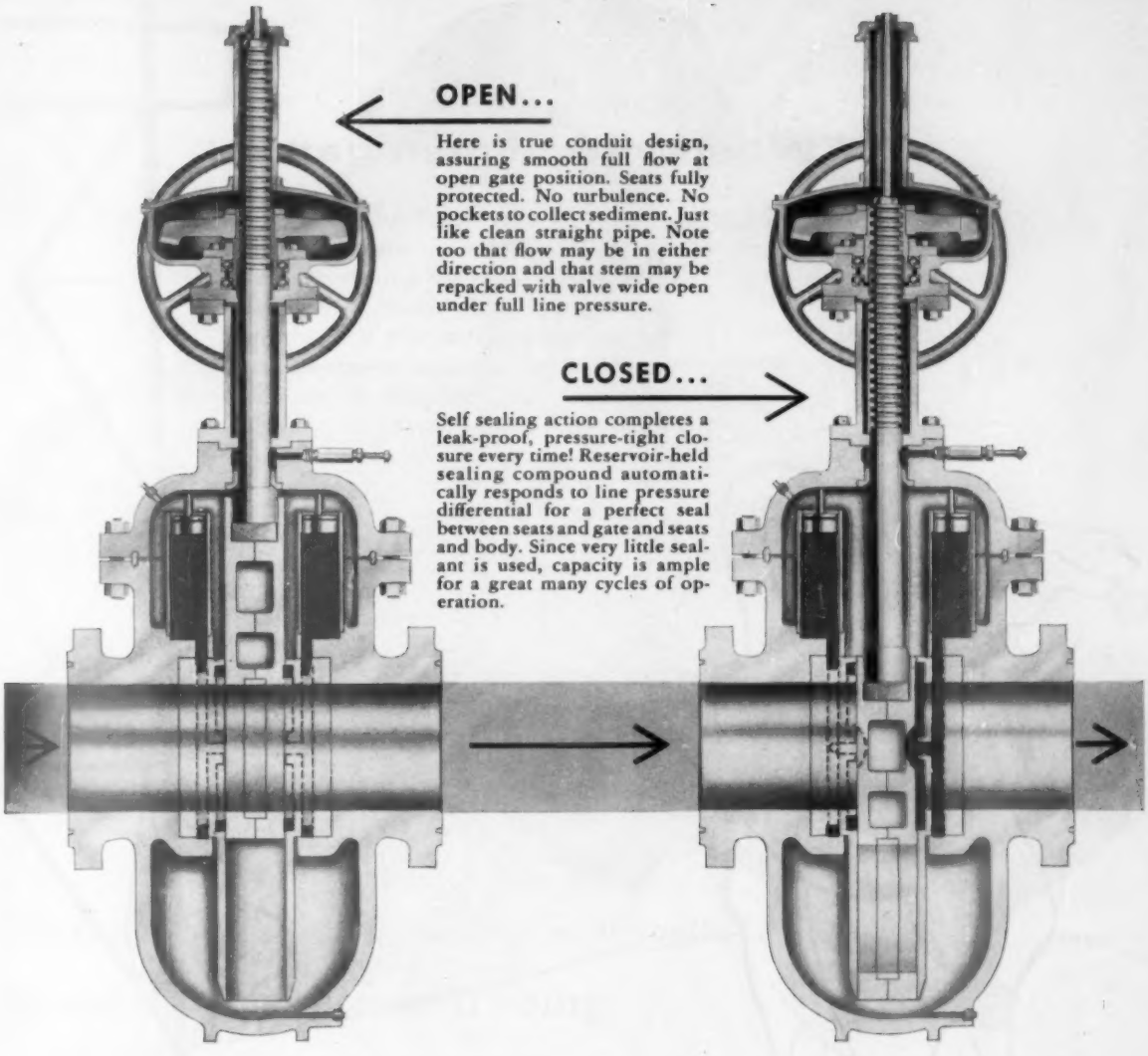
TEIA



TEXAS EMPLOYERS' INSURANCE ASSOCIATION

It's an "Open and Shut" case for...

DARLING-McEVOY CONDUIT GATE VALVES



OPEN...

Here is true conduit design, assuring smooth full flow at open gate position. Seats fully protected. No turbulence. No pockets to collect sediment. Just like clean straight pipe. Note too that flow may be in either direction and that stem may be repacked with valve wide open under full line pressure.

CLOSED...

Self sealing action completes a leak-proof, pressure-tight closure every time! Reservoir-held sealing compound automatically responds to line pressure differential for a perfect seal between seats and gate and seats and body. Since very little sealant is used, capacity is ample for a great many cycles of operation.

THESE and other features combine to make Darling-McEvoy conduit gate valves unique and unmatched in pipe line service today. They are now available in 4" and larger sizes, fully field proved, with experience a matter of record on various major lines. For detailed information ask for Bulletin 5402.

DARLING VALVES

DARLING VALVE & MANUFACTURING COMPANY

Williamsport 1, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

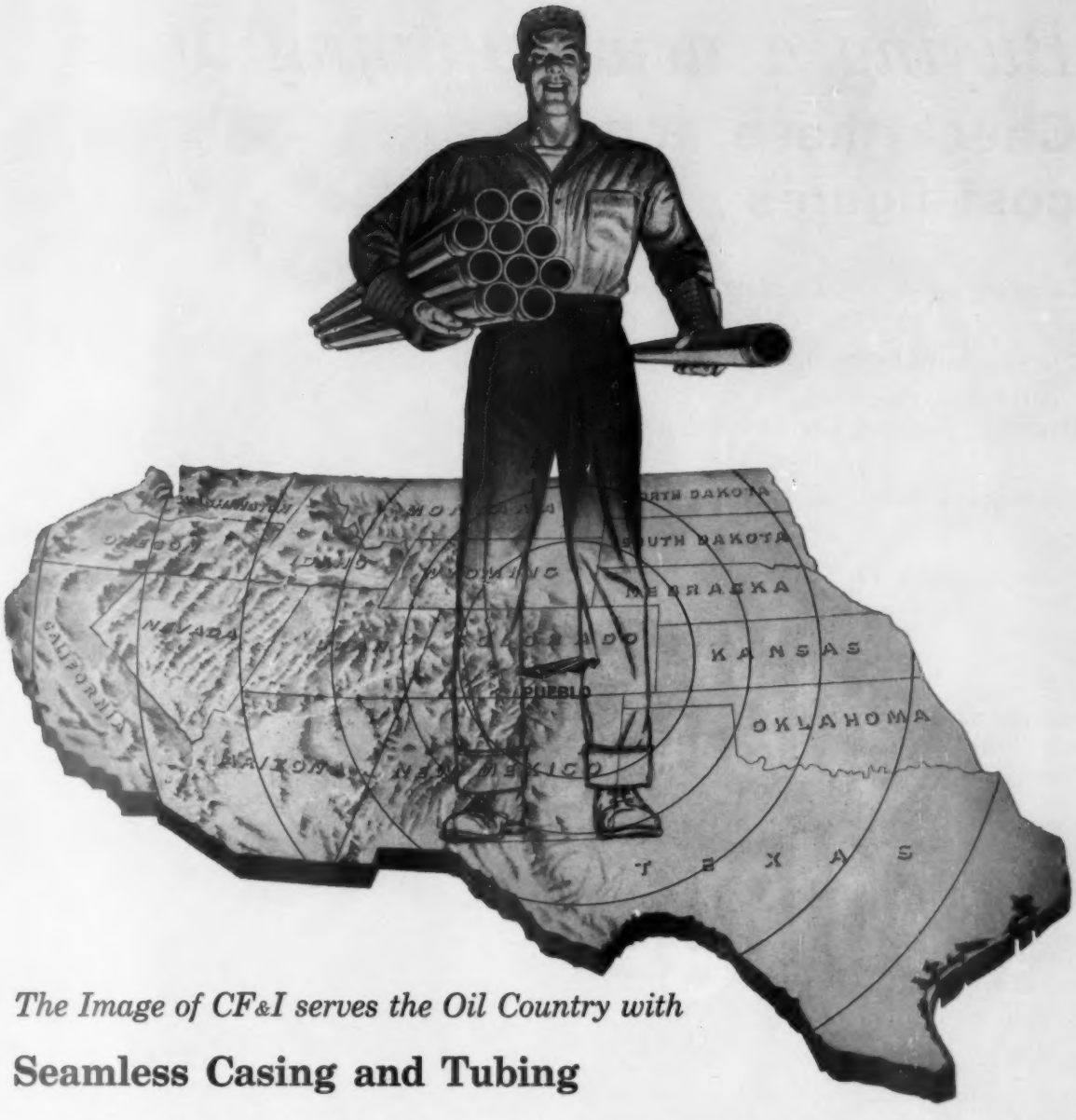
"Wherever oil men gather"

Oil . . . like gold . . . is where you find it. That may be miles out into the Gulf . . . under snow-crusted plateaus . . . or beneath hot desert sands. Wherever it is, when oil men get together, their conversation is richly colored with the imagination and specialized knowledge characteristic of their profession. And in the Southwest, when financial matters enter the conversation, you're sure to hear someone say, "For my money, it's The Fort Worth National Bank!"

THE FORT WORTH NATIONAL BANK

Helping Build a Greater Fort Worth and Southwest

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION
CAPITAL AND RESERVE ACCOUNTS OVER $20 MILLION



The Image of CF&I serves the Oil Country with

Seamless Casing and Tubing

The CF&I giant steelman stands for dependable steel products and dependable service. Nowhere is this fact better exemplified than in CF&I Seamless Casing and Tubing. The CF&I seamless tube mill was built in the heart of the oil country—Pueblo, Colorado—to enable us to give efficient service to western oil and gas companies.

CF&I Casing and Tubing has found widespread acceptance for product dependability. CF&I's manufacturing processes—from ore to finished product—include many unique quality control procedures. This attention to detail assures casing and tubing that will stand up under the most arduous operating conditions.

CF&I Seamless Oil Country Casing and Tubing meet API Standard 5A specification, and are available in sizes from 2⅜" through 9⅝" O.D.

6949

CF&I STEEL **SEAMLESS** *casing and tubing* API

THE COLORADO FUEL AND IRON CORPORATION • DENVER, COLORADO

Buying a new pumping unit?

Check these actual cost figures*...

These are the savings a leading independent operator made by purchasing a Johnston Hydraulic Pumping Unit rather than the conventional beam-type pumping unit.

*Name and letter available on request

Location: Collingwood #1, Haskell County, Kansas. **Depth:** 5700 ft.	**Conventional Beam-Type Pumping Unit**	**JOHNSTON** *Hydraulic* **PUMPING UNIT**
Cement Base	$ 1,200.00	NONE NEEDED
Sucker Rod String	¾" @ $61.70 Cft. 5700 ft. $ 3,282.08	⅝" @ $48.65 Cft. 5700 ft. $ 2,773.06
Cost of Unit, F.O.B. Liberal, Kan. Including Transportation Cost	$ 5,832.61	$ 2,550.53
Total Cost, Installed	$10,314.69	$ 5,323.59

Get the facts and figures for your next pumping unit—both ways. Figure all the costs involved with the conventional beam-type pumping unit. Get comparative cost figures from Engineered Oil Tools or your Johnston Hydraulic pumping unit distributor.

Compare the figures. You will quickly see why profit-minded operators specify Johnston Hydraulic pumping units when their wells go on artificial lift.

DISTRIBUTORS

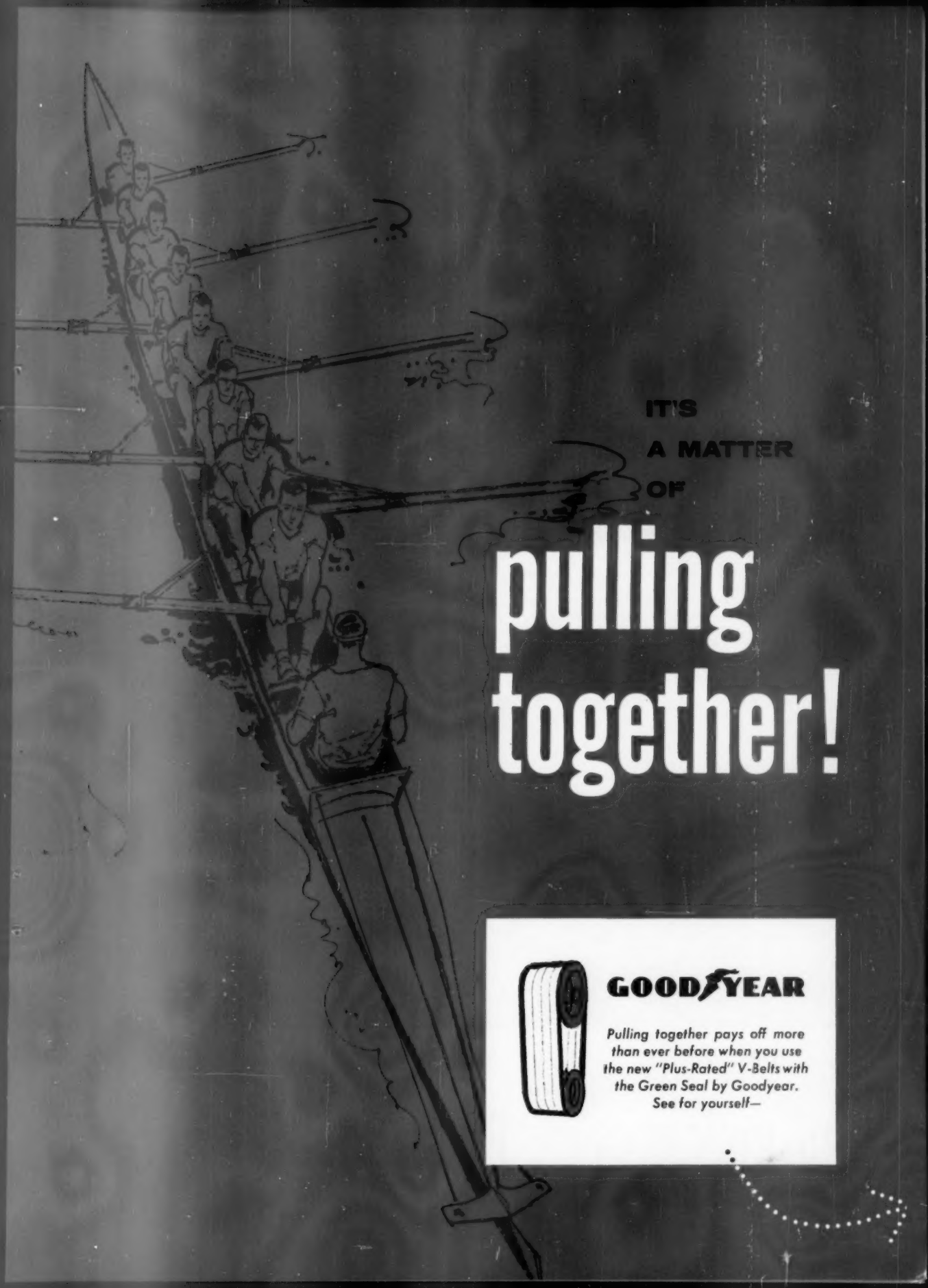
DOMESTIC: Bovaird Supply Co.; Lacy Oil Tool Co.; McJunkin Corp.; Production Equipment Products Co.; Union Supply Co.; Wilson Supply Co. CANADA: Canadian Well Services, Ltd. EXPORT: Wilson Supply Co., International Div.

3910

ENGINEERED OIL TOOLS INC.

1710 BURNETT ST. – HOUSTON, TEXAS

P. O. BOX 1665 PHONE FA 3-0293


IT'S
A MATTER
OF
pulling
together!
GOODYEAR
Pulling together pays off more than ever before when you use the new "Plus-Rated" V-Belts with the Green Seal by Goodyear. See for yourself—

Year after year—at plant after Goodyear V-Belts with the toughest jobs—at the lowest cost

—IN AN ILLINOIS GARAGE EQUIPMENT PLANT

Operation: Finishing surfaces of cylinders used on automobile lifts

Drive: Oily main drive of heavy-duty cylindrical grinder

Service: Set of 5 matched oil-resistant V-Belts with the Green Seal pulled together to give user 6 times the service of previous belts

—ON TEXAS WATERFLOODING PUMPS

Operation: Pressure-pumping salt water into "tired" oil wells to reactivate them

Drive: 15 h.p. pump drive that feeds salt water into wells under 600-900 psi pressure

Service: Five-belt set of V-Belts with the Green Seal pulled together, eliminating slippage problem caused by previous belts and averaging 2 years' service where others had failed in 6 months

—and now they're "Plus-Rated" for greater

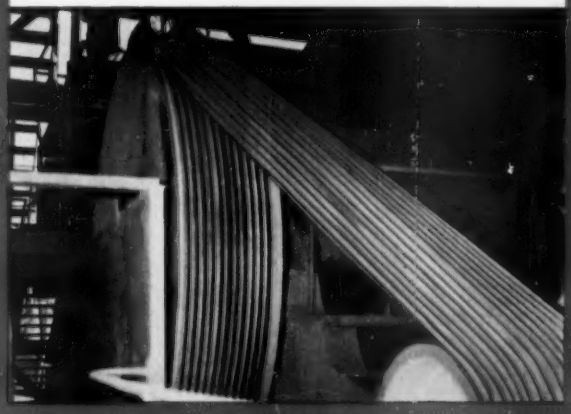
plant–on drive after drive–
the Green Seal handle
–over the longest trouble-free life–

–AT AN OREGON LUMBER MILL

Operation: Debarking giant logs
Drive: 25 h.p. 900-1800 r.p.m., 2-speed main drive on barker
Service: Matched V-Belts with the Green Seal–five to the set–pulled together and outlasted previous belts 14 to 1–eliminating down time–saving $40 a month to boot

–ON A PENNSYLVANIA ROCK CRUSHER

Operation: Crushing dolomitic limestone
Drive: Main drive on bulldog-type rock crusher
Service: Set of 14 matched V-Belts with Green Seal construction pulled together to crush 600,000 tons of limestone a year for 14 straight years–was still going strong at last report



horsepower-transmission per dollar!

HERE'S THE STORY .....

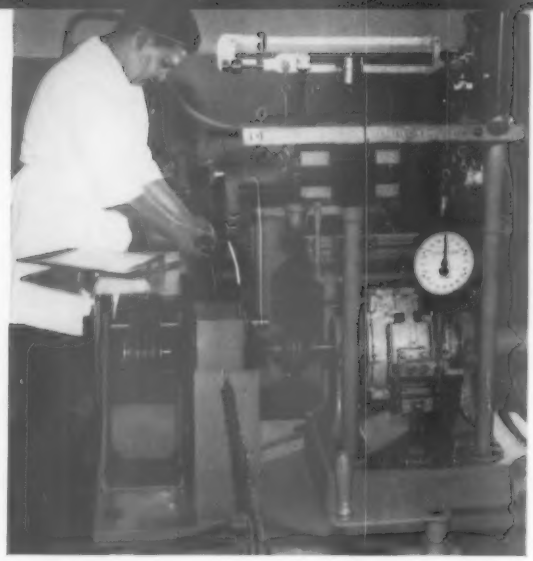
New

"Plus-Rated" V-Belts

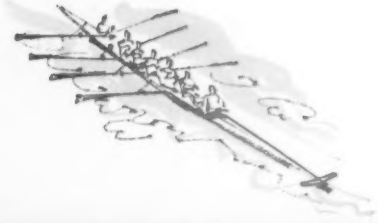
with the

Green Seal

give you all these "pluses"



- Bonus horsepower ratings at no extra cost
- Maximum horsepower hours per dollar of any belt you can buy
- Matched V-Belt sets that *stay* matched in storage—on the drive
- Unequaled stretch-resistance – thanks to high-modulus construction with load-carriers of airplane-type steel cable or 3-T cord
- Smooth-running uninterrupted performance with specially compounded non-dusting rubber covers that never stick in the grooves
- Maximum resistance to shock-loads—guaranteed by breaking-point tests that exceed the strain of severest service



—Add up all these plus features and you'll see why the new "Plus-Rated" V-Belts with the Green Seal are your best belt buy for longer-than-ever, more-trouble-free service at lower-than-ever cost. For details, contact your Goodyear Distributor—or clip, fill in, and mail the coupon below.

Green Seal—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

"PLUS-RATED" V-BELTS WITH THE GREEN SEAL BY

GOODYEAR

THE GREATEST NAME IN RUBBER

S-51165-X

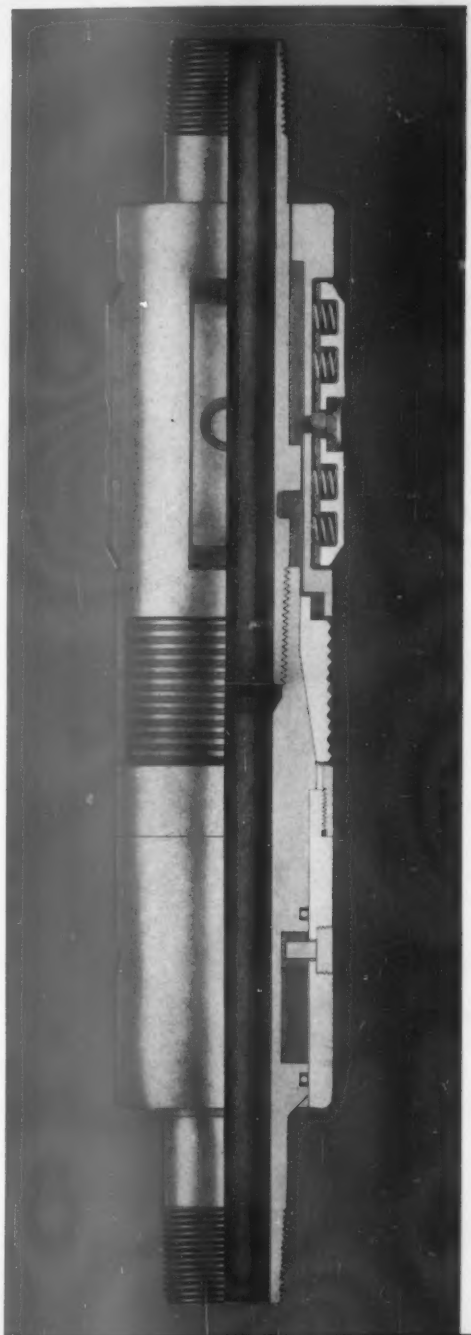
THE GOODYEAR TIRE & RUBBER COMPANY, Industrial Products Division, Dept. 794, Akron 16, Ohio
Please send me more information on the great new "PLUS-RATED" V-Belts with the Green Seal.

Name _____

Company _____

Street Address _____ City _____ Zone _____ State _____

AMERICAN IRON



TENSION TUBING ANCHOR

Prevents costly buckling and breathing of tubing!

Now, you can get more PROFITS from your pumping well by using the American Iron Tension Tubing Anchor to prevent costly sucker rod and tubing failures.

Set one of these short, compact tubing anchors at the bottom of your well and you have many money-saving advantages.

The American Iron Tension Tubing Anchor increases life of rods and tubing by decreasing thread wear on tubing and coupling. It also decreases OD wear of rod and rod coupling, and tubing coupling.

By firmly anchoring the tubing, you also increase the efficiency of the pump.

COMPLETELY RETRIEVABLE UNDER ALL CONDITIONS!

The American Iron Tension Tubing Anchor is another QUALITY product created through American Iron research and design for the petroleum industry.

AVAILABLE THROUGH YOUR SUPPLY STORE.

AMERICAN IRON

Another AMF Product PETROLEUM EQUIPMENT

AMERICAN IRON & MACHINE WORKS COMPANY, INC.
518 North Indiana Avenue • Oklahoma City, Oklahoma
Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY

AMERICAN IRON & MACHINE WORKS CO. INC. • OKLAHOMA CITY •

IF YOU HAVEN'T SEEN THE FRANKS *Explorer* IT'S NEW TO YOU!

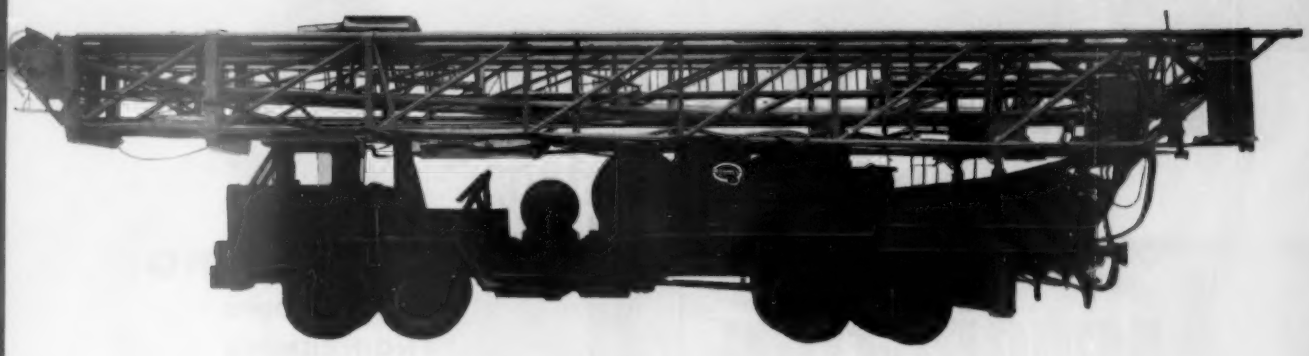
NOW OUTSELLING ALL COMPETITION SINCE ITS RECENT INTRODUCTION

FRANKS *Explorer Rocket*

FRANKS *Explorer Cruiser*

FAMOUS FRANKS FEATURES

24-hour service — Wheels to crown
27 years experience goes into Explorer
Explorers to fit any well depth
Industrial engines
Less maintenance
Explorers get on the job faster
Explorers service wells faster
No Federal excise tax
Explorers — Rated off highway, most states
Factory Service All Over The World



FRANKS
DESIGN FEATURES

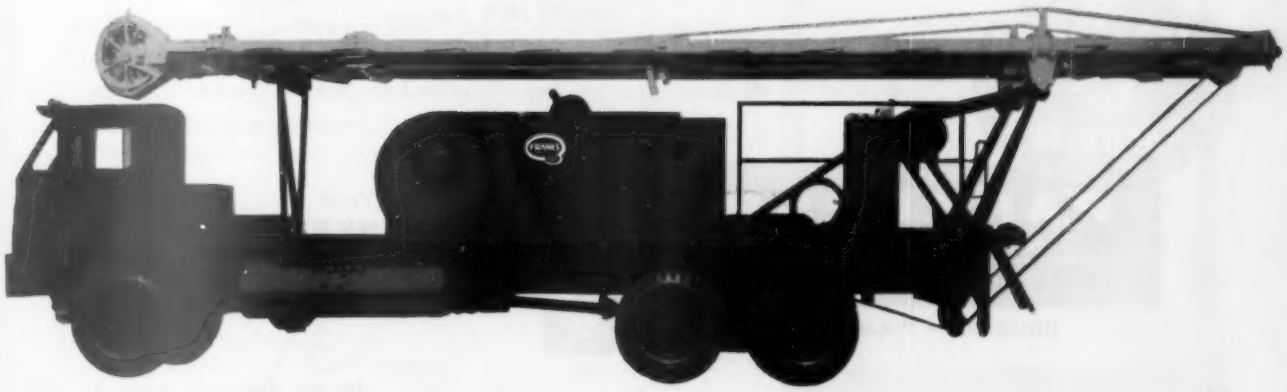
No sag — No bend frame
Safe front and rear rocker beam axle suspension
No heating engines
Servicing and workover on deepest wells
Derricks — True rated capacity 100,000# to 275,000#
Removable sand reel for lighter weight
New full view control console
Full view low silhouette drum guards
We predict Explorers to have higher used resale value
than other models

WELL SERVICING AND DRILLING UNITS
FRANKS
DIVISION OF
PAMPA, TEXAS
CABOT

Factory Service All Over The World

PROFIT MAKING FEATURES

Explorer Cruiser big power
Explorer Cruiser to match every job
Explorer Cruiser — Single or double pole mast
No sag — No bend frame
Franks proven full air clutch
Unexcelled drum brakes
New drums designed to take it, no spread flanges
New full view control console — safer



THE MIGHTY-MITE IN WATER ABSORPTION

ANOTHER
PARKERSBURG
OUTSTANDING
ENGINEERING
ACHIEVEMENT

NEW SPHERICAL GLYCOL UNIT

Patents Pending

With a basketball-size* spherical absorber, Parkersburg's new Mighty-Mite represents one of the most **outstanding engineering achievements** in glycol dehydration history.

Field tests prove that a dew-point depression of 65° F. can be guaranteed, with dew-point depression as high as 100° F. not uncommon.

The Mighty-Mite is a skid-mounted, compact unit no larger than the top of an ordinary office desk.

MIGHTY-MITE Features:

- Reduced purchase, operation and maintenance cost.
- Simple, trouble-free operation.
- Ideal for off-shore operations because of its light weight, space-saving size.

*** for 3 mm cu. ft./DAY CAPACITY.**

THE PARKERSBURG RIG AND REEL CO.
PARKERSBURG WEST VIRGINIA
QUALITY SERVICE
MADE IN U.S.A.

THE
PARKERSBURG
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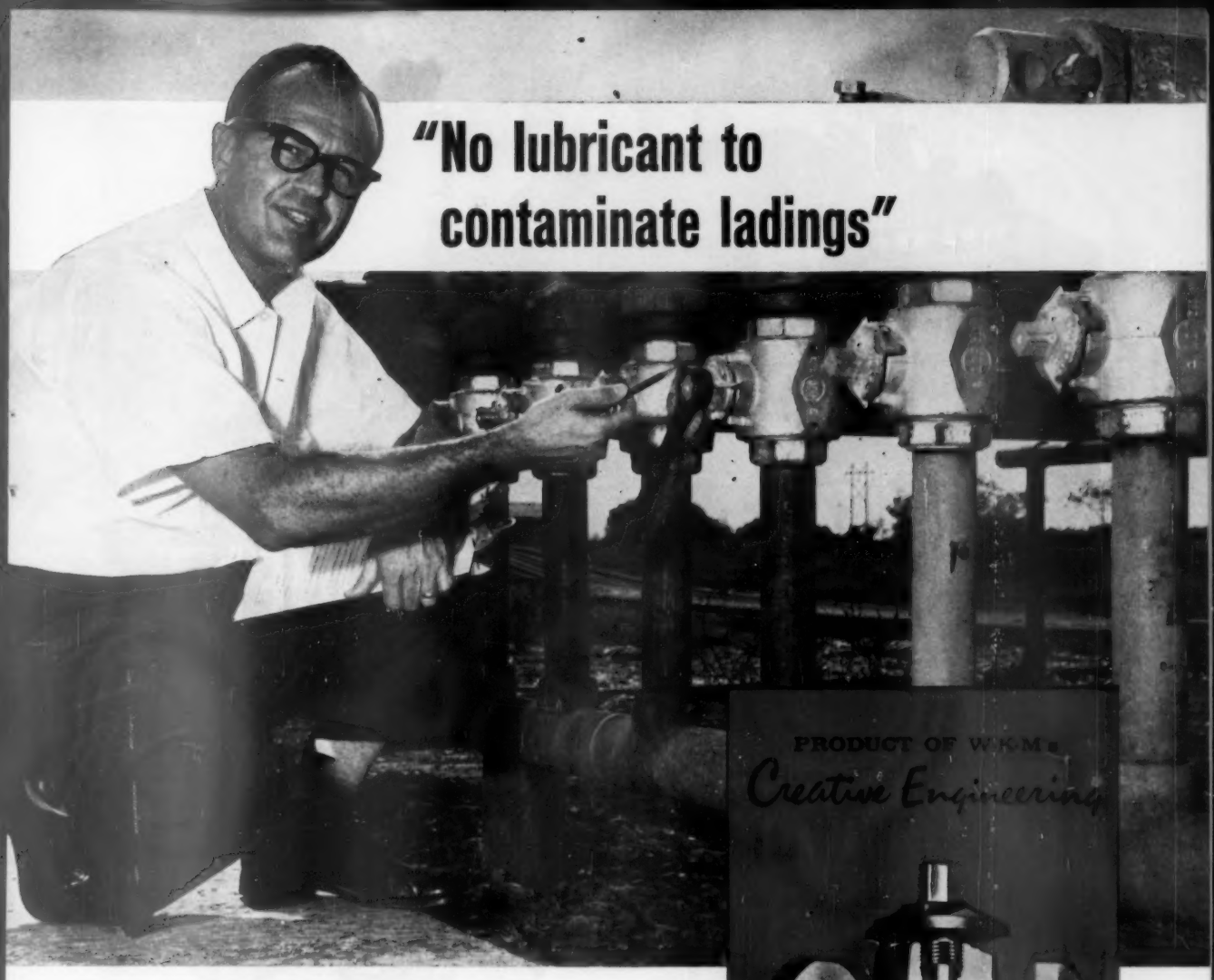
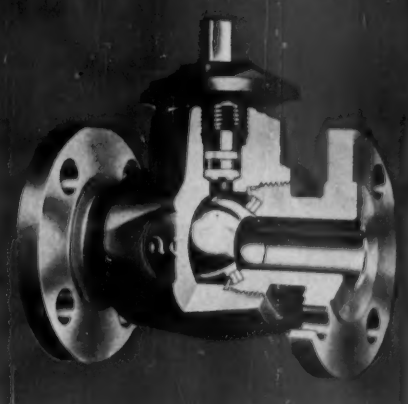
HOUSTON • TULSA • PARKERSBURG

See Your
PARKERSBURG
Man Today!



"No lubricant to contaminate ladings"

PRODUCT OF W-K-M *Creative Engineering*



ACF® non-lubricated Ball Valves

ACF Ball Valves are specially designed for ladings that require absolute purity. There is no lubricant, no possibility of contamination. The chrome-plated ball is suspended between Teflon seats under compression for leakproof sealing.

A quick quarter-turn operates this rugged valve. Specify it. You'll get efficient, economical performance. *Available at leading supply stores everywhere.*

Service-proved for 4½ years with such ladings as: high octane gasolines • alkalis • caustics • liquefied petroleum gases • butane • propane • synthetic fuels • penetrating gases • alcohol.

ACF non-lubricated Ball Valves feature full bore conduits, Teflon stem gaskets and seats that are sealed from the lading flow.

Working Pressures: In carbon steel with ASA ratings of 150 and 300, and a few sizes in ASA 600; in semi-steel with 200 and 400 pound ratings.

Sizes: ½" through 6".

W-K-M 40 SERVING INDUSTRY YEARS

WRITE FOR CATALOG 1000
W-K-M Division of ACF Industries, Incorporated
P. O. Box 2117, Houston, Texas

5911

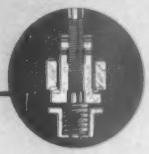
900 to 1400
HORSEPOWER

Big Drawworks with Small Rig Simplicity

Rated at 900 to 1400 net input horsepower, the Mid-Continent U-914-C Drawworks offers the drilling industry all the desirable features of a large rig, while retaining the flexibility and simplicity of operation of smaller units. The U-914-C is designed as a single package unit containing hoisting drum, transmission, rotary drive, and auxiliary brake on a single skid. Rugged in construction and smooth in operation, this unit provides dependable, economical and trouble-free service to meet present day drilling practices. For complete information, contact your local Mid-Continent representative.

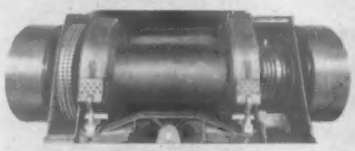
SELF-EQUALIZING
52" x 10" BRAKES

Double adjustment, individually equalized bands have spring loaded spherical dead-end equalizer seats which eliminate bending of the dead-end pins.



EXTRA LARGE BALANCED DRUM
FAWICK VC CLUTCHES

A 29" diameter by 53¼" long drum provides three wrap spooling when hoisting 90-foot stands with a 10 line reaving system using 1¼" wire line and LeBus grooving. Hi- and lo-drum clutches are identical 38VC1200 Fawick Ventorque. A splined clutch is provided on the lo-drum side for emergency use.



ALL BEARINGS GREASE LUBRICATED
UNITIZED CONTROLS

MID-CONTINENT SUPPLY CO.

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A KENDAVIS INDUSTRY

THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

ON SUBMERGED LINES–

Chiksan Swivel Joints flex freely with wave and tidal action

Swift tides and pounding waves make *flexible* offshore lines mandatory. To fill these requirements, producers turn to Chiksan Swivel Joints. Chiksan Joints in submerged service safely handle all maximum operating and surge pressures and provide the right degree of line flexibility to meet any tide and wave conditions. Moreover, Chiksan Joints are designed for salt water service and years of attention-free performance is common. Chiksan Joints and their partner Weco Unions are sold by leading supply stores everywhere.

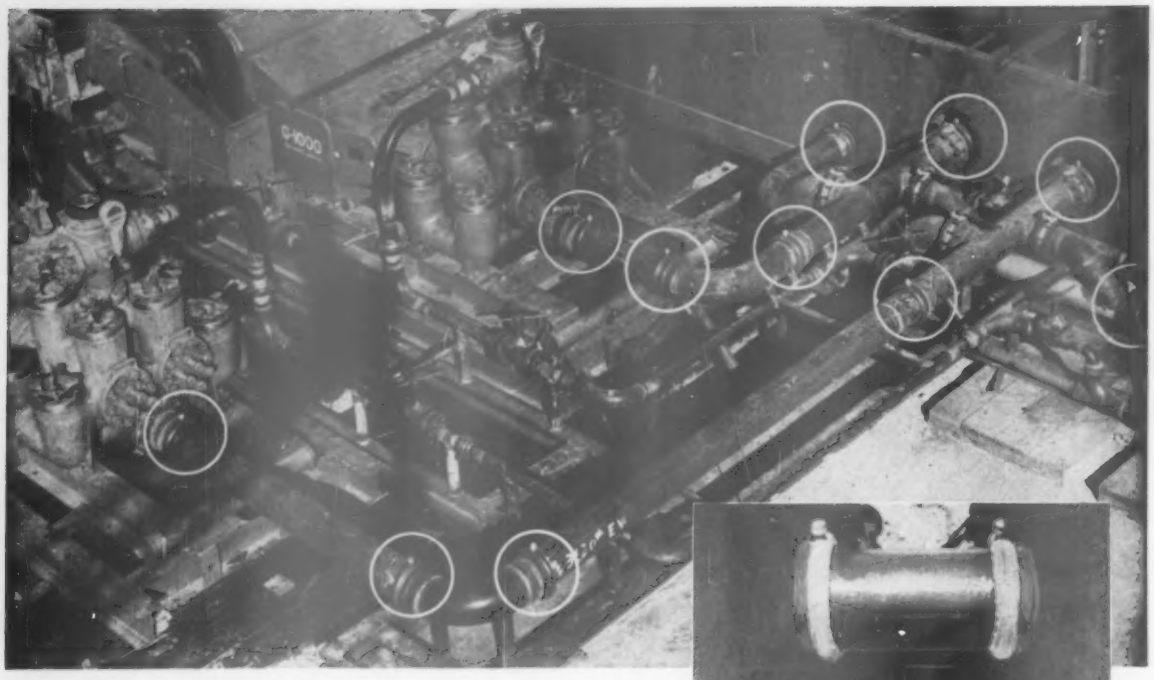
#59-44

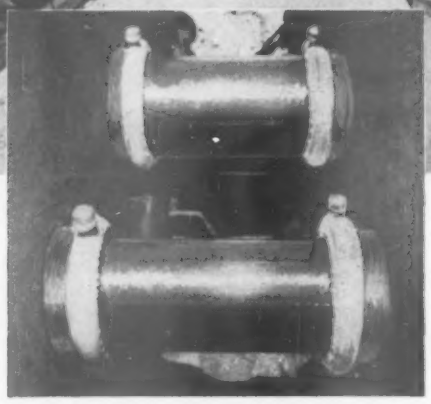
OIL'S FIRST CENTURY
-BORN IN FREEDOM
WORKING FOR PROGRESS

CHIKSAN fmc

A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

CHIKSAN COMPANY—Brea, Calif. • Chicago 5, Ill. • Newark 2, N. J. • Weco (Division), Houston 1, Texas • Subsidiaries: Chiksan Export Co. • Chiksan of Canada Ltd.





AIR-O-UNIONS on mud tanks and suction lines save hours of rig-up time. All you do is slip the pipe in place, inflate the tube and your suction lines are ready for service. (Inset) Installation of Air-O-Unions for compounding mud tanks.

The WECO AIR-O-UNION

PAT. PEND.

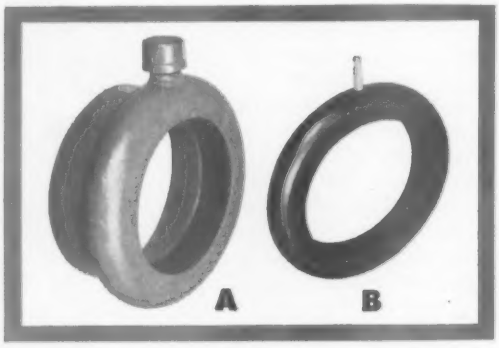
SEALS WITH A SHOT OF AIR

- **For Mud Suction and Return Lines**
- **For Low Pressure Fluid Lines**

AIR-O-UNIONS, now manufactured by WECO, are available from WECO and Chiksan representatives and supply stores throughout the world.

Air sealed Air-O-Unions give you a perfect seal on low pressure lines . . . make up fast and easy without close line-up . . . allow pipe expansion and mis-alignment without breaking the seal. No bolts, nuts, wrenches required . . . no threading or grooving is necessary . . . just use plain end pipe. Jab it through the union, inflate the tube and they're made up ready for service. To break out, just deflate the tube.

For efficient, low cost mud suction, mud return and other low pressure lines, install WECO Air-O-Unions. Ask your WECO Representative or your supply store.



AIR-O-UNIONS consist of only two parts, the union body (A) which is permanently welded in place, and the inflatable tube (B). Only replacement ever required is the tube. Sizes range from 6" to 16".

Switch to low cost, timesaving, simplified Air-O-Unions for all low pressure lines.

WECO

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of* FOOD MACHINERY AND CHEMICAL CORPORATION

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AO-2-59

The OIL AND GAS JOURNAL

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They Say—

Who's guilty?

Dear Sir:

In recent weeks the present oversupply of crude oil has been the subject of an editorial and several articles in your magazine.

Such statements as: "Only five producing states make any attempt to correlate output to requirements, and it is unfair for the five states to do this alone" have appeared. Some of these articles have been directly pointed at the State of Illinois and other small producing states in this area. Others actually blame the oversupply on production from these eastern and midwestern states and insist that these states should pass proration laws.

May I call your attention to a few facts? (statistics from your own publication). U. S. crude oil production—first half of the year. Amount of increase or decrease in thousands of barrels daily:

From 1948 to 1959 (net change)

Kansas	up	37
Louisiana	up	468
Oklahoma	up	149
Texas	up	411

A total increase from the prorated states of 1,192 thousands of barrels per day!

Illinois	up	41
Kentucky	up	46
Ohio	up	6
Indiana	up	15
Pennsylvania	down	18
West Virginia	down	1.4

A total increase from six nonprorated states of 88.6 thousands of barrels per day—an increase of less than one-tenth of that of the five prorated states!

In all of the 22 nonprorated states the total increase was 480 thousands of barrels per day less than the increase of production in the five prorated states.

During the 11-year period consumption in the six nonprorated states increased many more times than did their additional production. In the prorated states production has increased far more than consumption.

Are the prorated states really holding back production as they claim?

For the State of Illinois to enact proration legislation . . . would be sheer economic stupidity until such time as its own production is equal to or greater than its own consumption.

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PACKAGED, AUTOMATIC STEAM GENERATORS . . .

Top Efficiency for Oil Country Requirements

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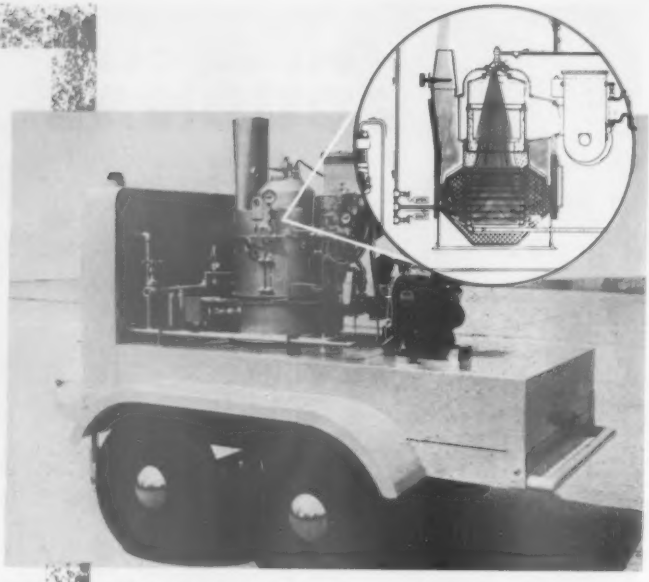
Contact your Texsteam representative for full information on TEX-Steamers — HP ratings from 10 to 125, standard working pressure range: 75 to 600 psi. Higher steam outlet pressures on application.

May we forward our detailed TEX-Steamer Bulletin No. 100C?



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Are the prorated states willing to cut their production back to the amounts consumed in their states? I think not!

Are you aware that the average production of wells in Illinois is about 6 bbl. per well? Do you suggest that these stripper wells be prorated? Even on a 9-day-a-month basis most Texas wells produce more than that.

John L. Lester
Petroleum Geologist
Centralia, Ill.

(Editor's note: Both groups have increased output almost exactly 33%.)

Rules with bite needed

"Naturally, as one of the companies which sponsored the construction of a big-inch pipeline to Montreal, we are disappointed in the (Borden) commission's recommendation against its construction at this particular time.

"However, our primary objective in advocating the Montreal pipeline, was to expand our crude-oil production. If the same ends can be achieved by the Borden proposals, we wholeheartedly support them. We are pleased with the clear indication of the report that failure by the international oil companies to reach the level of 700,000 bbl. production per day in 1960 will open the Montreal market to Alberta crude oil.

"We are, of course, aware of the splendid effort made over many months by Imperial Oil Ltd. to arrange just such oil trades as the Borden Commission proposes. However, the failure of industry effort to achieve any important results certainly lends emphasis to Premier E. C. Manning's comments that the National Policy will have to contain regulations with teeth in them."

R. A. Brown, Jr., president of Home Oil Co., Ltd., in a statement following release of second Borden Report.

Canada must look to future

"The commission quite rightly concluded that an Edmonton-Montreal crude oil pipeline is uneconomic and can only be made possible by government regulations to limit competition in the Quebec market. We believe that from a national standpoint the reservations expressed by two members of the commission, Dr. G. E. Britnell and Dr. R. D. Howland, are most pertinent. The report tends to consider today's marketing problems without sufficient regard for the future.

"Imperial Oil has done a great deal to develop markets for crude production for the Canadian oil industry as a whole, including the risking of many

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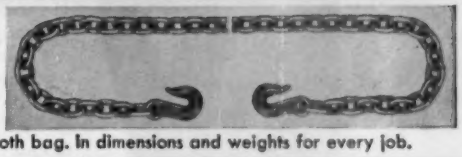

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millions of dollars in refineries and transportation facilities in addition to guarantees to enable the construction of pipelines. With these, and facilities provided by others, this year's production level should reach an all-time high, even exceeding the previous peak year achieved during the Suez crisis.

"As an illustration of export market development, for 3 years we have been making the kind of crude-oil exchange which the report recommends. Under an arrangement with a nonaffiliated refiner on the U. S. West Coast, we now use some of that company's Venezuelan production in eastern Canada. In turn, this U. S. company takes Western Canadian crude at its West Coast refinery. As a result, one-third of our refinery runs at Montreal are, effectively, Canadian crude."

J. R. White, president of Imperial Oil, Ltd., in a statement following release of second Borden Report.

Alaskan economics

"While it may cost a great deal more in Alaska than in any other state to find oil and start it to market, it may turn out that it may produce more barrels of oil per dollar of outlay than any other state. . .

"Sinclair looks at Alaska as a relatively long-term investment."

William H. Morris, president, Sinclair Oil & Gas Co., in a speech to the Anchorage, Alaska, Chamber of Commerce.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR OF EVENTS

SEPTEMBER

27-29 National Association of Oil Equipment Jobbers, annual convention and trade show, Hotel Leamington, Minneapolis.

27-30 American Institute of Chemical Engineers, national meeting, Hotel St. Paul, St. Paul.

29-30 Western Petroleum Refiners Association, management seminar, Western Hills, Wagoner, Okla.

28-Oct. 1 American Welding Society, fall meeting Sheraton-Cadillac Hotel, Detroit.

29-Oct. 1 National Association of Corrosion Engineers, western region conference, Bakersfield Inn, Bakersfield, Calif.

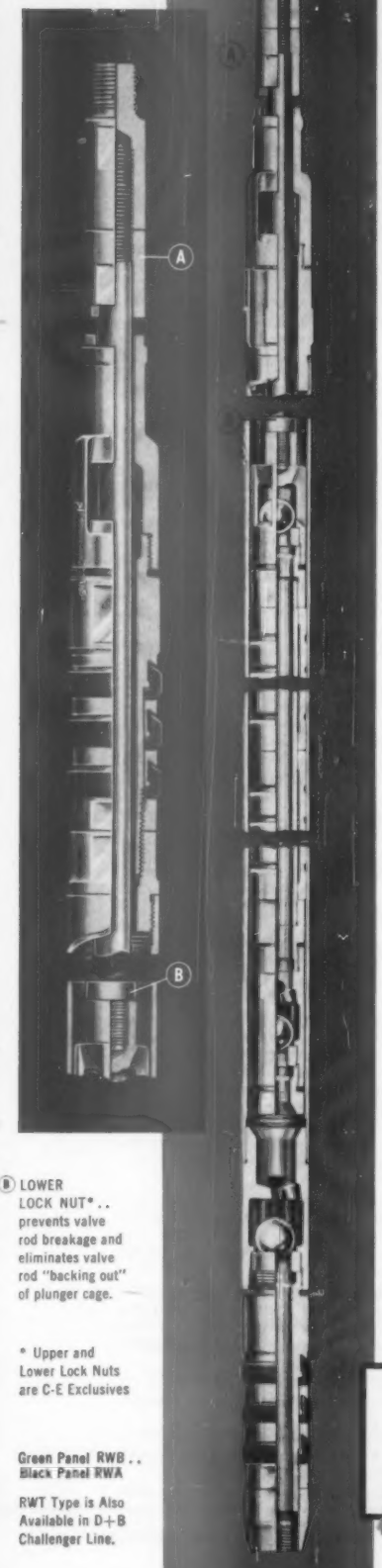
OCTOBER

1-2 National Association of Corrosion

It takes only one line
to pump all medium to deep wells

CONTINENTAL-EMSCO D+B CHALLENGER PUMPS

Ⓐ UPPER LOCK NUT*.. prevents breakage of valve rod and eliminates unscrewing.



Ⓑ LOWER LOCK NUT*.. prevents valve rod breakage and eliminates valve rod "backing out" of plunger cage.

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Various metals, pump types and pump combinations give *extra flexibility* to D+B Challenger pumps. Interchangeability of their API parts cuts inventory costs. Types are available for all well conditions.. crooked or slant holes.. medium deep to wells over 7,000′. Challenger pumps can be assembled to pump stripper wells, sandy or gaseous fluids. Many corrosive resisting plunger-barrel tube combinations and special cages, fittings and balls and seats can be selected to handle sweet, sour or oxygen corrosion. Special pump combinations to provide extra volume, pump extremely gaseous fluids and meet other well peculiarities can be assembled from standard Challenger pump parts with the use of only a few special parts.

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Put D+B Challenger pumps
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For Service that Sings.. Equipment that Hums.. Go..

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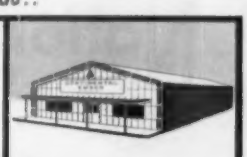

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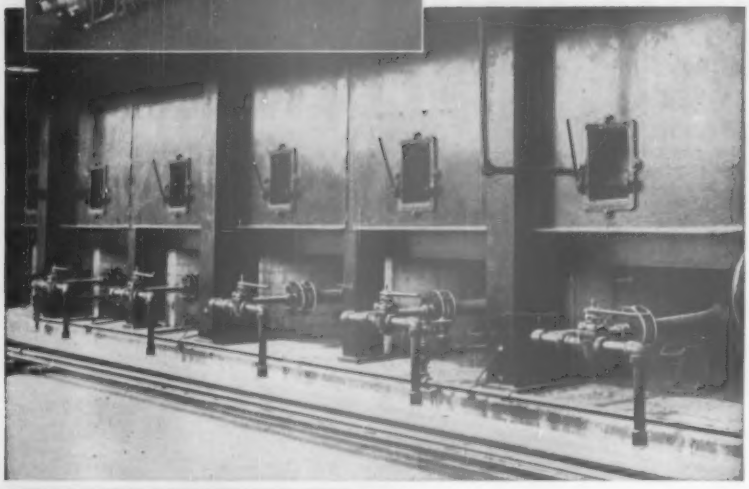

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Engineers, southeast region conference, Jacksonville, Fla.

2 Society of Petroleum Engineers of AIME, Billings, Mont., petroleum section, field trip to Elk Basin field.

2-3 Association of Desk and Derrick Clubs of North America, eighth annual convention, Hilton Hotel, San Antonio, Tex.

4-7 Society of Petroleum Engineers of AIME, fall meeting, Memorial Auditorium, Dallas, Tex.

5-7 American Gas Association, annual meeting, Conrad Hilton Hotel, Chicago.

5-7 National Association of Corrosion Engineers, northeast region conference, Lord Baltimore Hotel, Baltimore.

5-10 Society of Automotive Engineers, national aeronautic meeting, aircraft engineering forum, and aircraft engineering display, The Ambassador, Los Angeles.

7-8 Western Petroleum Refiners Association, fourth annual stream pollution and waste disposal conference, Broadview Hotel, Wichita.

7-10 Rocky Mountain Association of Geologists, eleventh annual field conference, Saratoga Inn, Saratoga, Wyo.

8-9 California Natural Gasoline Association, annual fall meeting, Huntington-Sheraton Hotel, Pasadena, Calif.

8-10 American Association of Petroleum Geologists, Southwestern Federation of Geological Societies, second annual regional meeting, Coliseum, Lubbock, Tex.

8-10 Exploration Drilling symposium, sponsored by University of Minnesota, Colorado School of Mines, and Pennsylvania State University, University Park, Pa.

8-11 Louisiana Gulf Coast Oil Exposition, Lafayette, La.

9-10 Appalachian Geological Society, Pittsburgh Geological Society, field conference, Cacapon Lodge, W. Va.

11-13 American Association of Oilwell Drilling Contractors, annual meeting, Skirvin Hotel, Oklahoma City.

11-16 American Society for Testing Materials, Pacific area national meeting, Sheraton - Palace Hotel, San Francisco.

12-15 National Association of Corrosion Engineers, south central region conference, Cosmopolitan Hotel, Denver.

13-14 Seventh Annual Gas Measurements Institute, National Guard Armory, Liberal, Kans.

16-17 University of Texas, E. P. Schoch lectures series, process control, University of Texas, Austin.

20-22 American Standards Association, national conference on standards, Sheraton-Cadillac Hotel, Detroit.

20-22 National Association of Corrosion Engineers, north central region conference, Cleveland.

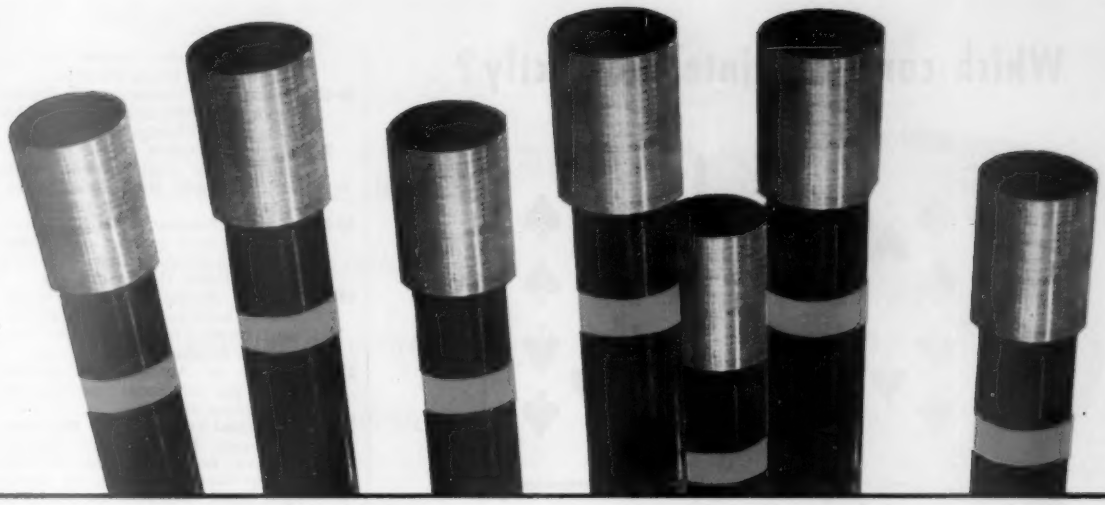
20-22 American Society of Mechanical Engineers, American Society of Lubricating Engineers, lubrication conference, Sheraton - McAlpin Hotel, New York.

22-23 American Institute of Mining, Metallurgical, and Petroleum Engineers, Los Angeles Basin section, fall meeting, Huntington Sheraton Hotel, Pasadena, Calif.

23 Natural Gasoline Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.

26-27 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

26-27 Independent Natural Gas Associa-



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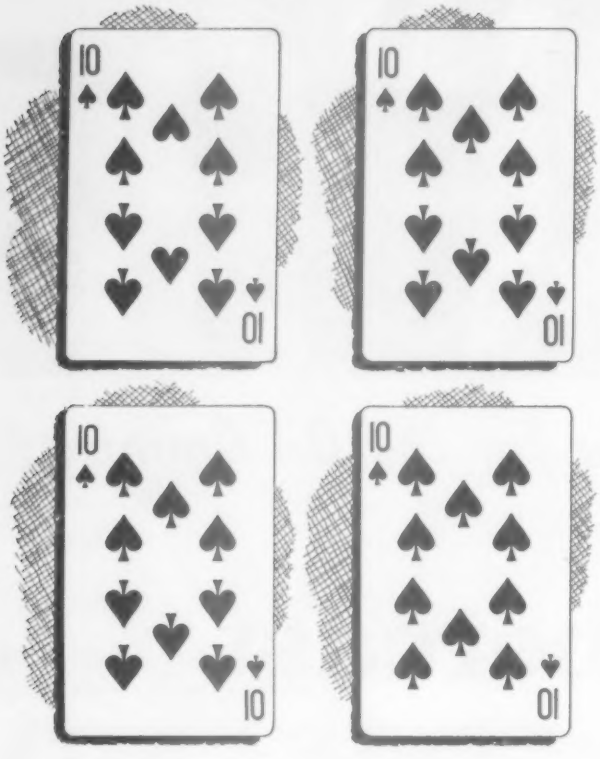

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tion of America, annual meeting, Westward Ho Hotel, Phoenix.

26-28 Society of Automotive Engineers, national transportation meeting, La Salle Hotel, Chicago.

27 American Institute of Chemical Engineers, New York section, technical symposium, Hotel New Yorker, New York.

28-29 Western Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.

28-29 Armour Research Foundation of Illinois Institute of Technology, annual computer applications symposium, Morrison Hotel, Chicago.

28-30 Society of Automotive Engineers, fuels and lubricants meeting, La Salle Hotel, Chicago.

28-30 American Association of Petroleum Geologists, Mid-Continent regional meeting, Broadview Hotel, Wichita.

29-30 Oil Recovery Symposium on Southwest Texas, sponsored by southwest section of AIME and Texas Petroleum Research Committee, Driscoll Hotel, Corpus Christi, Tex.

NOVEMBER

2-4 Geological Society of America, annual meeting, Penn-Sheraton Hotel, Pittsburgh, Pa.

4-6 Rocky Mountain Oil and Gas Association, fourteenth annual convention, Brown Palace Tower, Denver.

4-6 Institute of Radio Engineers, national automatic control conference, Sheraton Hotel, Dallas.

9-10 National Academy of Sciences-National Research Conference, first international symposium on fire research, National Academy of Sciences, Washington.

9-11 American Petroleum Institute, thirty-ninth annual meeting, Conrad Hilton, Palmer House, and Congress hotels, Chicago.

9-12 Society of Exploration Geophysicists, twenty-ninth annual meeting, Biltmore Hotel, Los Angeles.

16-20 Fifth International Automation Congress and Exposition, New York Trade Show building, New York.

17-18 Natural Gas Pipe Line Institute, new Seward County Courthouse, Liberal, Kans.

19 West Central Texas Oil and Gas Association, annual meeting, Hotel Windsor, Abilene, Tex.

20 Natural Gasoline Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.

20 Appalachian Geological Society, technical meeting, Charleston, W. Va.

22-29 Third Venezuelan Geological Congress, sponsored by Venezuelan Society of Geologists and Venezuelan Ministry of Mines and Hydrocarbons, Caracas.

29-Dec. 4 American Society of Mechanical Engineers, annual meeting, Chalfonte Haddon Hall, Atlantic City, N. J.

DECEMBER

3-5 American Chemical Society, southwest regional meeting, Baton Rouge, La.

3-5 Interstate Oil Compact Commission, annual meeting, Sheraton Hotel, Philadelphia.

6-9 American Institute of Chemical Engineers, annual meeting, Sheraton Palace Hotel, San Francisco.

11-15 Society of Automotive Engineers, meeting, Sheraton-Cadillac and Statler Hotels, Detroit.

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in oil-well completions

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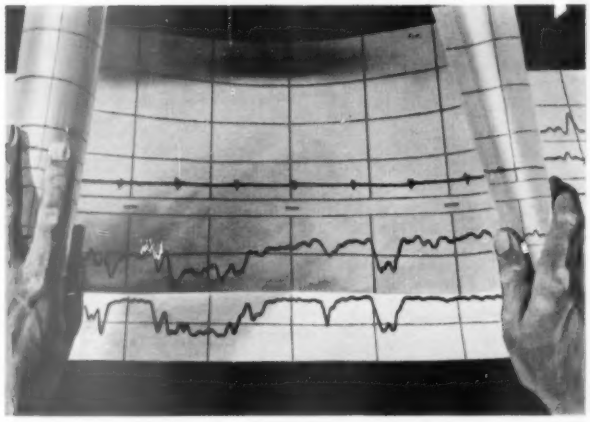

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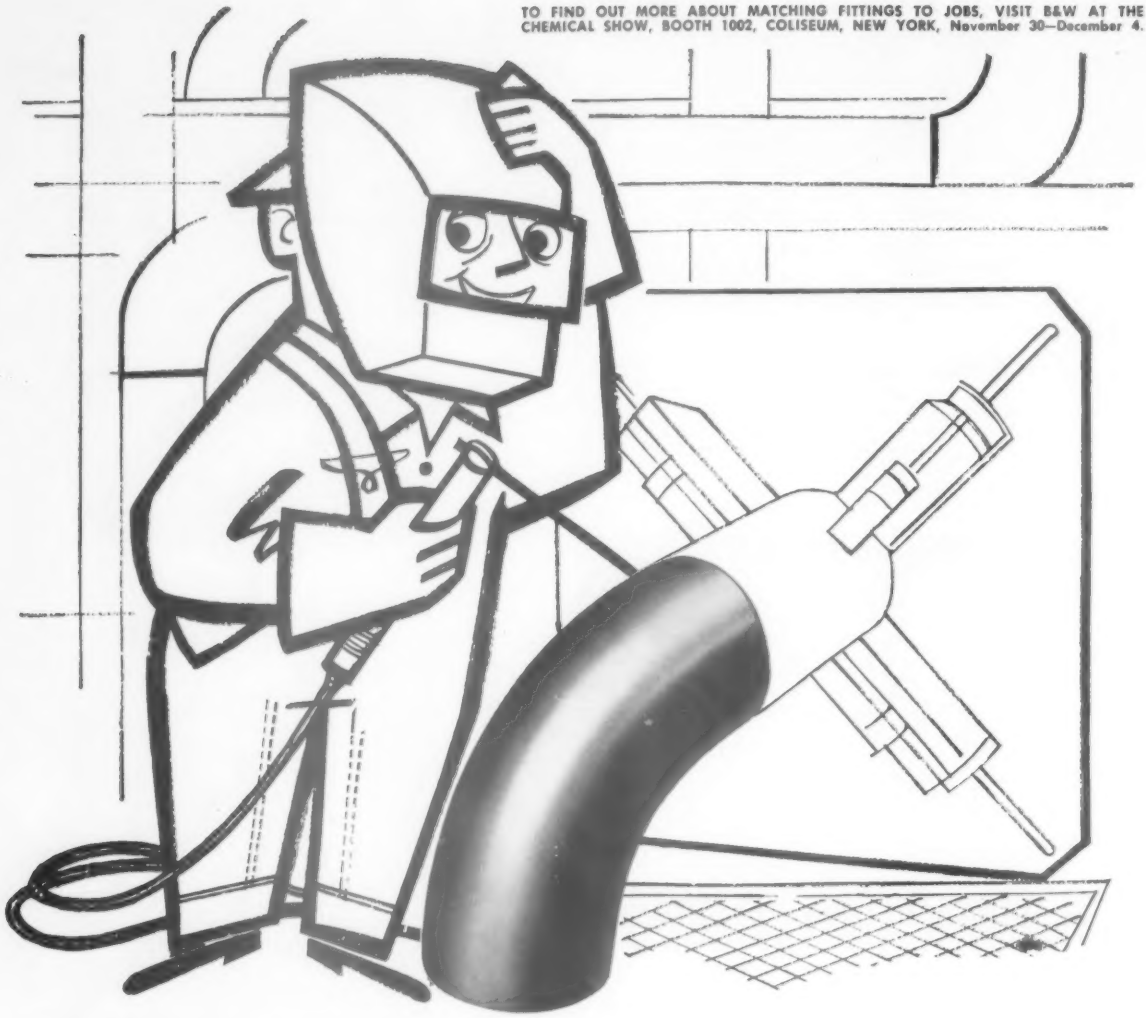

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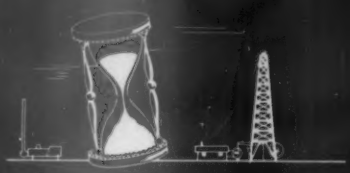

50 years ago

October 6, 1909

Governor Haskell of Oklahoma proposes state-financed pipeline to Gulf Coast to provide market outlet and relief for state's hard-pressed independent oil producers. Countering, Standard Oil Co. considers formation of separate Oklahoma company to build line to connect with line Standard of Louisiana is laying from Northwest Louisiana to its new refinery nearing completion at Baton Rouge.

United States district court at McAlester enjoins state authorities of Oklahoma from preventing Kansas Natural Gas Co. and other "foreign" corporations completing their pipelines out of Oklahoma and piping gas to other states. Decision in this celebrated case lets bars down for all waiting to move Oklahoma gas outside the state.

Disastrous Gulf hurricane levels 94 derricks in Jennings area of South Louisiana. Only 57 derricks survive.

25 years ago

September 27, 1934

New oil discovery by Otto Woods opens Sam Fordyce field as first production in Hidalgo County, Texas' Rio Grande Valley. Discovery well, 1 Lawrence, flows 25 bbl. of oil per hour through ⅜-in. choke from 2,750-ft. Frio sand.

United State district court at Guthrie, Okla., holds federal control of drilling and production of oil and gas within a state unconstitutional. Far-reaching decision in famous Eason Oil Co. case declares federal petroleum administrator (Secretary of the Interior Harold Ickes) without power to stop well Eason is drilling in Crescent field, Logan County.

Humble Oil & Refining Co. cements record-length string of 13⅜-in. casing in projected deep well at Goose Creek in Harris County, Texas Gulf Coast. String totals 5,318 ft. of 68-lb. Grade C pipe giving load of 360,000 lb.

10 years ago

September 29, 1949

William R. Boyd, Jr., president of American Petroleum Institute since 1941 and a leading figure in the oil business for 29 years, announces his retirement following next API annual meeting in November.

Kansas court upholds power of Conservation Commission to establish a minimum wellhead price for natural gas in the vast Hugoton field.

Gulf Oil Corp. controls record-high flowing pressure of 7,890 psi. in completing its 1 Perry deep discovery well in the Peach Point area, in Brazoria County, Texas Gulf Coast. Well flows gas and condensate from 11,300-ft. sand.

JOURNALLY SPEAKING

No Oil-Stained Dodgers

IT APPEARS the Los Angeles Dodgers won't be sloshing around in an oil-filled baseball park after all.

This conclusion comes about thusly:

When the Dodgers quit Brooklyn for Los Angeles a couple seasons ago, the first thing they did was shop around for a ball-park site.

It happened that there was a nice chunk of unused city-owned real estate virtually in the center of Los Angeles. It's called Chavez Ravine.

In what was expected to be a routine deal, the Dodgers opened negotiations with the city for the purchase of Chavez Ravine for its new park.

Immediately a small group of citizens, backed by a couple of city councilmen, screamed like eagles.

They claimed Chavez Ravine was merely Mother Nature's way of covering up the biggest oil field since East Texas.

After months of haggling, court suits (some still pending) and a city election to approve the deal, the sale was made. But only after the Dodgers agreed to give up mineral rights to the property.

Recently, the city decided to put Chavez Ravine's prospective oil value to the test. City Oil Administrator William L. McCoy invited 23 oil companies to bid on drilling rights.

Last week, McCoy honed up his letter opener in preparation for the deluge of offers the critics of the sale to the Dodgers assured everyone would pour in.

The results:

Only 8 of the 23 companies even bothered to reply. And they merely said they weren't interested. The other 15 didn't feel it was worth even the price of a 4-cent stamp to say "thanks, but no thanks."

McCoy profoundly observed:

"Failure to receive bids leads me to the conclusion no one believes there is any oil under Chavez Ravine."

Editors Are Just Like People

THE ADVERTISING department loves to boast to prospects about the "40-odd editors" on the Journal staff.

Actually, editors aren't really odd. Most of them, at least. Well, some of them. They're generally oppose sin, salute the Flag, owe money on their car, don't shave on Saturday, and either play golf or fish. Just like people.

And when they're not writing significant, if very straight and proper, articles for Journal readers, they sometimes let their hair down and write for each other.

We have, for example, a Journal publication which just goes to other members of the staff to keep them informed. Here are some quotes from last Friday's issue:

"Editor George Weber and Howard Wilson covered the Texas Mid-Continent meeting in Houston, with Wilson doing the writing. The editor already had writer's cramp from his Green County opus."

"Back from their honeymoon, Sara and Maury Duncan have set up housekeeping in an apartment. Sara's report on the first day: 'I had to get up at 6:15 to cook breakfast. It was ghastly!' We don't know whether she was referring to the hour or to breakfast, but that evening the newlyweds went out for dinner."

"Lynn Nichols is faced with a perplexing plight—pigeons. The feathered specialists in aerial bombardment roost around Nick's church—Boston Avenue Methodist. The ladies carry umbrellas in self-defense. Nick, a member of the church board, is charged with helping find a solution to the problem. Nick has attacked the problem with a vengeance, for he is a Purple Heart veteran of the pigeon war. He remembers vividly the day he was a victim of fowl play. He stepped out of the church and, gentleman that he is, doffed his hat to a lady. There are 5,700 members of the church and a pigeon per member. Shooting and poisoning are out, so they put out a trap—but somebody stole the trap. The battle rages on, with the pigeons winning."

There's a lot more, but this is enough to show you what editors do on their own time. Like we said, they're just like people.

—Bill Smith.

Avoid the harmful effects of welding on high-grade casing shoes and collars by using BAKERLOK.

Bakerlok–instead of Welding!

BAKERLOK'D joints withstand greater break-out torque than welded joints —at one-fifth the cost!

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The break-out tester (above) was used repeatedly for simultaneous breaking-out of identically made-up joints, one with BAKERLOK on the *pin threads only*, and the other joint welded with three two-inch beads. Gradually increasing torque was applied, and . . . time after time the welded joints broke first. Further tests under constant vibration, with variances in make-up and temperature proved beyond question that BAKERLOK was far superior to welding.

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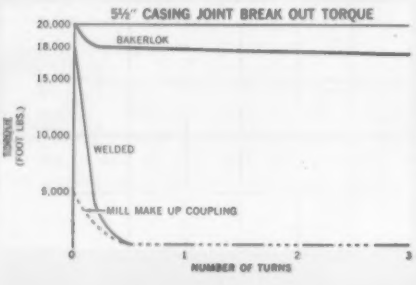

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Seeds of destruction are being sown in Oklahoma

OKLAHOMA OIL MEN are confronted suddenly with a political battle. Its outcome could produce serious economic pains throughout the domestic industry. The real victim might be conservation.

Cause of the rising furor is this proposal: Amend the state constitution to provide for a minimum 50-bbl. daily allowable for each well in the state.

Dissident independent producers are seeking signatures to petitions for a referendum on the issue. Chances of their getting the necessary signatures are good. Danger that the amendment will carry is real.

It's easy to see the voter appeal of the 50-bbl.-allowable drive. There's a sort of pie-in-the-sky lure to arguments for the idea: It'll help the small producer . . . Nearby states are running more oil than Oklahoma . . . The big companies can be made to find a market for the little man's oil.

DESPITE THESE APPARENT ATTRACTIONS, actually there's nothing good we can say about this proposal.

Oil buyers, production men, proration attorneys all agree it is loaded with dangers to the industry. These are studied in detail elsewhere in this issue (p. 43). It's sufficient here to say the 50-bbl. allowable would wreck conservation in Oklahoma and spread the seeds of market destruction.

Such an allowable written into the state constitution would be inflexible. It could be changed only by a slow, cumbersome election. It would hamstring the corporation commission in adjusting production to meet market demand.

The quick and inevitable result would be overproduction in Oklahoma. Distress oil seeking a market would move at cut-rate prices. This would mean only one thing: A chain reaction of price cuts for all crude.

Would surrounding states which also prorate stand by and see their markets flooded with cheap Oklahoma oil? Hardly. If Texas producers, for instance, became infected with this "I'll-get-mine-now" attitude, they easily could break the world oil market. The Texans have saved the industry from market chaos for months now by tight proration.

But lower prices wouldn't be the only evil.

You can imagine what would happen to wells whose production now is limited because of high gas-oil ratios. And to wells restricted because of heavy water production. Heavy production of such wells would ruin the gas cap or water drive in their reservoirs. Conservation would go out the window.

WHAT'S THE ANSWER THEN? The same for Oklahoma oil men as for the whole industry these days.

Oklahomans must explain the situation simply to their customers and the public. They must convince their friends and neighbors—over the back fence, on the street, over the luncheon table, through news media.

The Journal feels this local campaign is important to every oil man, because how Oklahoma makes out will have a bearing on future stability of the entire oil industry.

NICKEL ALLOYS PERFORM BETTER LONGER
Tubing safety valve is being readied for use in Texas well. All vital parts of the mechanism are made of long-lived, corrosion-resisting Monel alloy to assure positive shut-off if surface equipment should fail. Made by Otis Engineering Corporation, Dallas, Texas.

A wild oil or gas well is tamed by this Otis tubing safety valve. It automatically shuts off flow when wellhead connections fail. All vital parts are Monel* nickel-copper alloy to assure dependability. Monel alloy resists erosion, corrosion by sour crude or gas... makes oilfield equipment as foolproof as possible. Complete information? Ask us for "Metals To Make Petroleum Production Equipment Produce More." *Inco trademark

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Opposition to 50-Bbl. Minimum Grows

• Journal study shows virtually all of Oklahoma's oil industry is firmly opposed to such a high floor under allowables. Biggest fears: It would weaken prices, undermine conservation, discourage deep drilling.

STRONG opposition was building up in Oklahoma last week against a campaign to make mandatory a 50-bbl. daily minimum allowable for each well.

Major buyers, refiners, and producers joined with a group of independents in declaring the proposal would:

...Hamper efforts of the Oklahoma Corporation Commission to regulate the oil and gas industry in the state.

...Result in overproduction of crude.

...Depress crude prices.

...Weaken conservation efforts.

...Backfire economically on small producers and discourage larger operators to continue deep drilling.

...Fail to benefit the teachers, county officials, and general taxpayers who are supposed also to prosper from increased tax income off the greater production.

The proposal is being advanced by a newly formed Oklahoma Independent Producers and Royalty Owners Association, spearheaded by W. A. (Gus) Delaney, Ada, and Quentin Little, Ardmore. (OGJ, Sept. 21, p. 116).

The 4-year-old Oklahoma Independent Petroleum Association headed by Paul Schultz, Tulsa, announced opposition to the idea immediately. Journal interviews of buyers, refiners, and producers of both major and independent companies last week found the opposition nearly unanimous.

Political strategy . . . Delaney's aim is to write the 50-bbl. daily minimum into the state constitution.

Then it can't be changed by commission action or repealed by the legislature. Changes could be made only by another vote of the people—a slow and complicated process.

Delaney's group plans to circulate petitions calling for an election on amending the constitution to include the basic allowable. He actually will need about 85,000 signatures but plans to get at least 125,000 to insure sufficiency. After the required amount is obtained, a special election will be set or the question scheduled for the ballot at the next general election.

Delaney says he has no preference on an election date. The primary next summer would be agreeable, he adds.

Oil men opposing Delaney's plan declare there is a real danger of his winning an election. They fear that Delaney's arguments will sway an uninformed electorate. They know there is political pie-in-the-sky for promises that greater allowables will help the small oil man, mean more tax money for teachers, county roads, government.

Aim of Schultz and the OIPA is to arouse others in the industry to the dangers and help inform the general public on the question.

Both the Delaney and Schultz groups aired their views last week at the monthly corporation commission allowable hearing in Oklahoma City. Later the commission increased the October allowable to 17 bbl. daily.

A mockery . . . Many oil men think the 50-bbl. arbitrary allowable will make a mockery of conservation in Oklahoma and injure the cause throughout the oil country.

The constitution would supply a floor through which the corporation commission couldn't go in setting the state's allowed production. This means the commission:

...Couldn't adjust downward to market demand.

The regulatory body would have to accept a 50-bbl. allowable no matter how low the demand for Oklahoma crude fell.

...Would have to favor one segment of the industry.

By law the commission would have to give first shot at the market to the marginal wells, small producers, waterflood and salt-exempt wells.

The deep, expensive wells would be limited to 50 bbl. daily unless demand were especially heavy. Thus the deep wells, which presently get larger allowables, would bear the brunt of any allowable reduction.

...Would find relations complicated with purchasing companies.

The commission now has a rule that a crude purchaser must take the full allowable of producers connected to its gathering lines. The commission may grant exemption after hearing on a request by the purchaser. This rule is being tested in court by Gulf Oil Corp. It has resulted in Gulf and Texaco, Inc. selling their Oklahoma gathering systems and ending their buying activities in the state.

Some major company executives warn that if production is allowed to rise above market demand, the commission will have trouble. It can't force companies to take the full allowable if they have no market for the oil. To do so could lead to a greater exodus of oil companies from Oklahoma.

Production men also are vitally concerned at the effect of a 50-bbl. compulsory allowable on conservation practices.

What will happen to wells whose production is now restricted because of high gas-oil ratios? Will they be allowed to produce 50 bbl. daily even if excessive gas drainage results? Such a practice would dissipate the gas cap of a pool. It would leave a big volume of oil stranded in the reservoir either to be lost forever or reclaimed only by expensive secondary-recovery methods.

What about wells producing excessive water? Are they to be restricted to preserve the reservoir's water drive in order to increase ultimate recovery?

Spacing limitation is another big question. Present trend is toward wider spacing to recover the same amount of oil with fewer wells at lower production costs. But a 50-bbl. fixed allowable might be the economic incentive in some areas to drill on much smaller patterns. This would mean more drilling but also greater per-barrel costs of production and greater volume of production.

Excessive production? . . . There's honest disagreement on just how

How Phillips Sees the 50-Bbl. Issue

PHILLIPS Petroleum Co. is Oklahoma's first major oil company to announce an official stand against a proposed 50-bbl. daily mandatory allowable for each well. Here is Phillips' statement:

"Phillips Petroleum Co. is unalterably opposed to the constitutional amendment for establishment of a 50-bbl. per well per day minimum allowable for oil wells in Oklahoma.

"An arbitrary minimum allowable of 50 bbl. per day will result in removing essentially all of Oklahoma's oil wells from the restricted allowable rates established by Oklahoma's Corporation Commission for the purpose of conserving the state's oil resources.

"The immediate effect will be a total oil production from the state for which there is no market. Oil purchasers cannot purchase oil for which they have no market. They, therefore, will in turn be forced to impose restriction upon the producing wells in order to be assured that they get no more oil than they can use.

"The over-all effect, then, of the 50-bbl. minimum, will be merely to force substitution of purchaser proration for proration that is now imposed by a state regulatory body in the interest of conservation.

"This, to the responsible oil operators in the state, is an entirely unsatisfactory substitution. The state's conservation agency charged with the enforcement of the conservation laws of the state, and which is doing a commendable job, would become entirely powerless to act."

much production would result from a 50-bbl. allowable.

Delaney says it would mean about 575,000 bbl. daily production in Oklahoma. Massena Murray, state conservation director, concedes this estimate may be in the ball park. He is unable to give a more accurate estimate until his staff can find time to make a study of potential-test data.

Many oil men believe Delaney's estimate is much too low. Production for the first 12 days of September under a 14-bbl. daily allowable was 507,350 bbl. daily. Last year Oklahoma's 79,425 wells averaged 547,817 bbl. daily for a per-well average of 6.9 bbl. daily.

But in the first half of 1959, Oklahoma oil men added 1,421 new crude producers, sending the state's total number of oil wells past 80,000. Oil men contend these 80,000-plus wells under a 50-bbl. minimum allowable can be made to produce more than 575,000 bbl. daily. Oklahoma in the postwar era has had 165, 125, and even 75-bbl. daily allowables. But there were fewer wells and demand then topped the 600,000-bbl.-daily mark.

Everyone agrees greater production is good—if the market exists for the oil. Anything that increases production above demand creates a problem. Continued excessive production has one result: Softer prices.

Delaney contends the oil buyers will take the increased production if pressured by greater allowables. He argues that Oklahoma has allowed its markets to be squeezed by adjoining states that have greater allowables. He adds that price reductions, if they occur, will be equitable on everyone. The producers will still have larger income because of his stepped-up runs.

The major buyers of Oklahoma crude paint a far different picture. They declare that purchasers can't possibly take all the increased production possible under a 50-bbl. allowable.

Producing more oil won't create new markets alone, they argue. Oklahoma's market predicament is a matter of geography and economics. Running at capacity, Oklahoma refiners can use only 388,000 bbl. daily. This home market normally is nearer 300,000 bbl. daily. The remainder of Oklahoma's production must be sold out of the state.

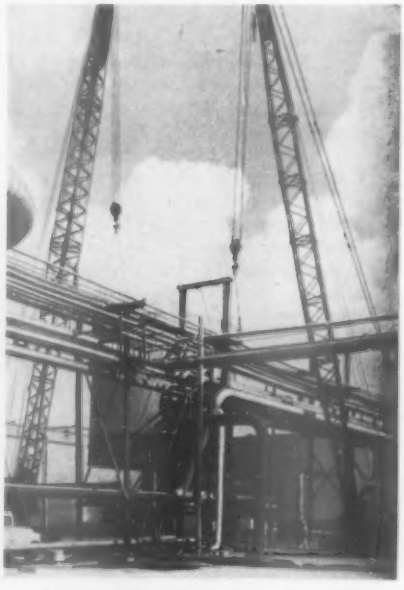
Oklahoma oil doesn't move south anymore because Texas and Louisiana production, enjoying a better location and lower transportation costs, has grabbed the Gulf Coast refining market. Result is Oklahoma oil moves north and east to the Kansas City, St. Louis, and Chicago refining centers. There it competes with crude from Texas, Kansas, Illinois, the Rockies, Canada.

Buyers say greater production won't carve out any more of the market for Oklahoma crude. If the greater output drops prices, Oklahoma crude will have a temporary advantage. But other crudes would adjust, and the competitors again would be on an equal price footing. The result well could be an over-production-price cut spiral that could ruin everyone.

One buyer comments the proposed 50-bbl. allowable "would completely wipe away any confidence our sister states have in proration. They certainly would increase their allowables and then we'd all be up to our necks in oil."

A backfire . . . Delaney tells The Oil and Gas Journal his plan is being advanced because the little oil producer is going bankrupt on the present 14-bbl. allowable.

But Murray and several oil men point out that the 50-bbl. allowable could prove too expensive for some operators. It would work like this: The corporation commission probably would figure each well individual-



1. Operation gets under way as two cranes begin lifting the tank.

Aerial Ride Is

WHEN ESSO Standard Oil Co. decided recently to move a huge tank at its Baton Rouge refinery, the result was "Operation Overlift"—a ticklish maneuver that required raising the tank over two pipe bands.

Here's a blow-by-blow account of the operation, in which Tank No. 440 left the old Wax Sweaters area for the

ly instead of on a lease basis in calculating allowables.

This immediately would triple production costs for wells now classified in unallocated fields. Wells in this classification usually pump their crude to a lease tank. But on an individual basis, each well would have to have a tank capable of storing 10 days supply of oil. Other equipment, such as meters would be needed. Other added costs would involve gagers and taking of potential tests.

Marginal producers in unallocated fields can't make 50 bbl. daily over a long period. Costly equipment on them would have a long payout at best.

Spokesman for one of the state's larger purchasers also declares the small producer will be hurt in another direction by Delaney's plan. He would find it difficult to get his wells connected to a pipeline in new areas.

Larger purchasers who also have production will make connections to their own leases first and will back away from new connections for others in the new areas. The unconnected production will be distress oil. The operator will have to bear the heavier costs of trucking this oil out if he can find a market.

Dimmer future . . . The proration attorney for one Oklahoma company declares a mandatory allowable would slow down the search for deep oil reserves in the state.

He explains the Delaney proposal would trim the allowables for deep wells to give more to shallow producers. The incentive thus would be to drill shallow wells instead of the much more expensive deep ones. But Oklahoma's future big production, according to geologists, most likely will come from the deeper horizons.

Drillers should be enticed into taking the risks of the costly deep wells by higher allowables. The present system attempts to do this by giving some weight to depth and cost in calculating allowables.

No bonanza . . . The tax harvest which Delaney believes may result from greater production actually may be pretty slim.

Critics of the plan point out these possibilities:

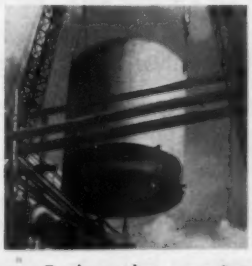
. . . Tax income wouldn't jump much if the increased production resulted in sharp price drops. There's a possibility the tax income could decline.

. . . Less taxes would result from the loss of crew payrolls, lease money, and royalty payments blocked by declines in deep drilling.

The consensus of oil buyers, company executives, and many independent operators is that the mandatory minimum allowable is unworkable. Both Oklahoma and Kansas in the past have had statutory 25-bbl. daily well allowables. Both states abandoned them as being unrealistic.

There's no reason to believe that doubling the compulsory allowable now would make it any more workable.

2. Then comes ticklish job of moving tank over pipes.



3. Tank makes crossing without backswing.

4. Crane "walks" tank to second lift site.

5. After the second lift, the tank is pushed into final position by fork-lift truck.

Given Tank in Esso's "Operation Overlift"

refined wax area at the big refinery.

A 60-ton crane with a 100-ft. boom and a 40-ton crane with a 90-ft. boom—one on each side of the pipe band—grabbed the tank at four points and began the lift. With precision teamwork, the crane operators raised the tank above the pipe band level and began slowly to move it across. At the crucial point it completed the crossing without any backswing—a feat that required nerve and know-how (Photos 1, 2, and 3).

Next, the 100-ton crane was maneuvered under the pipe band, and large wooden mats were laid in position to underlie the crane. This helped distribute the weight of the crane as it picked up the tank again. The crane, its boom almost vertical, "walked" the tank toward the second pipe band, where the two cranes again joined forces to make the second lift. Once over the second pipe band, No. 440 was moved to its final destination and nudged into position by a fork-lift truck (Photos 4 and 5).

How Octanes Would Increase With More TEL

	PREMIUM			SUPER-PREMIUM		
	3 cc/gal.	4 cc/gal.	Change	3 cc/gal.	4 cc/gal.	Change
Research Octane No.	99.7	100.5	+ .78	102.7	103.5	+ .76
Motor Octane No.	90.2	91.1	+ .94	93.1	94.4	+ 1.29
Sensitivity*	9.5	9.4	− .10	9.6	9.1	− .50
TEL Susceptibility						
R.O.N.	6.2	7.0		5.8	6.6	
M.O.N.	7.2	8.1		7.0	8.3	

*Research octane rating minus motor octane rating.

Lifting TEL Barrier Doesn't Mean Sudden

• Most gasolines now under old limit of 3 cc. per gallon. However, the 4-cc. level will help some refiners keep pace in the octane race.

INCREASING permissible tetraethyl lead concentration in motor fuel from 3 cc. to 4 cc. per gallon won't cause any rush to boost average lead levels. Most gasolines are well under the old limit.

However, lifting the TEL barrier for the first time in 33 years gives some refiners a push in the octane race. These are mostly small and medium-sized refiners and those who have been turning out super-premium gasoline.

They have been blending up to the limit and are expected to beef up their blends further now to meet stiff octane requirements. However, total gallonage involved is not expected to be substantial.

For the industry as a whole, increasing the arbitrary limit on lead content is academic. With the exception of the super-premium gasolines, lead concentrations in premium and regular blends have averaged below the 3 cc. level. Average TEL in regular has been dropping the last few years, but has shown a slight increase in recent months.

Here's how the average TEL concentrations stood in August: 2.52 cc. per gallon for premium and 1.88 cc. per gallon for regular. Concentrations in the super premiums can't be averaged because of lack of data. However, most of these third grades contain between 2.75 and 2.95 cc. per gallon.

So here's the outlook:

... **Isolated increases** in lead concentrations to fit individual circumstances.

... **No industry push** to increase average lead levels above the old 3 cc. mark, even in the next 5 years.

Recommendations . . . In lifting the TEL limit, Dr. Leroy Burney, surgeon general of the Public Health Service, advised that any increase be done gradually.

The 3 cc. figure was a voluntary industry level established in 1926.

Following a study, a special committee appointed by the Public Health Service concluded the lead content could be raised to 4 cc. per gallon without any significant increase in the hazard to public health and no increase in the danger of manufacture or distribution. (OGJ, Sept. 21, p. 103).

In increasing the limit, the committee recommended:

... **That the increase** in average lead content should not exceed ¼ cc. per gallon in any one year and that the total average content should not exceed 3.2 cc. per gallon at the end of 5 years.

... **The industry** should supply annual figures to the Public Health Service on use of TEL.

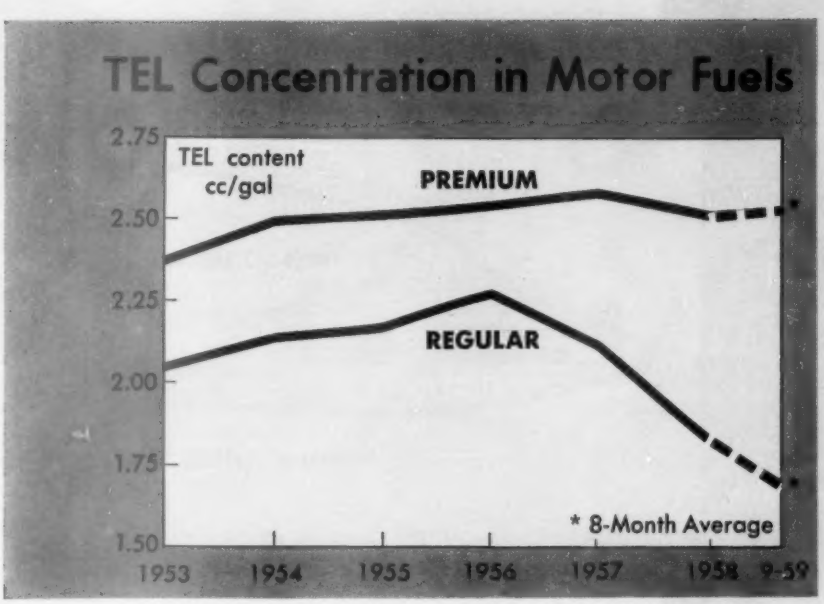
... **The Public Health** Service along with TEL manufacturers and the oil industry should conduct studies to get more definite data on levels and trends of atmospheric lead contamination.

Gain in octane . . . On the surface, in talking about 99-100 octane gasolines, the effect of adding the extra cubic centimeter of lead doesn't sound too dramatic.

Research octane numbers would increase only about .75 and motor octane number gains would be around 1 to 1.25 on an average blend. Individual blends will naturally vary, but on the whole these are about the gains which would be realized.

These additions, however, come at the top of the octane scale where each increment becomes especially costly to the refiner.

During the past years, with the exception of a few months, octane numbers have been rising. In August, new record levels were reached again in both premium and regular grades. Premium's weighted average came to 99.2 RON, compared with 98.5, 12 months ago. Housebrand values averaged 92.1 up .9 over a year ago. Ef-



Surge in Lead Content

forts of the industry in recent years to stay with the race are reflected in tremendous additions to downstream processing units, such as catalytic reforming, alkylation, and catalytic cracking. More recently they have been looking towards the isomerization process as a means of increasing octanes.

There is a possibility that the increase in permissible lead levels may slow down introduction of the isomerization process throughout the industry. There already has been a slowdown on this front due to the upsurge in alkylation and aromatics production capacity, both high octane blending components.

Alkylate is far superior to aromatics for it has an extremely low sensitivity. Being a paraffin, it also has a much better susceptibility to lead and hence will have a greater octane appreciation for each additional cc. of lead than aromatics or olefins.

Aromatics and olefins, incidentally, have partially accounted for a general decline in lead susceptibility in motor fuels. Since they have been playing a big role in premium fuel blends, they have resulted in lowering susceptibility of these fuels during the past few years. Regular motor fuel, on the other hand, has a better susceptibility to lead and the additive will cause a greater octane increase at lower costs in the housebrand gasolines.

Sensitivity . . . One aspect of the higher lead level is the improvement in the motor octane number.

In the past few years the motor octane number has become of increasing importance. Refiners have been working to reduce the spread between motor and research numbers.

Motor is usually lower than research number, and the difference between the two, called sensitivity, had been on the upswing in the premium gasolines. This high sensitivity results in part-throttle knocking in some of the new engines.

Last year, after a continued rise, the sensitivity of the premium grades dropped slightly. In 1957, sensitivity was better than 10.5. Last year it averaged 10.1. As motor numbers rise faster than research numbers when the lead content goes from 3 to 4 cc. per gal, this gap would be narrowed a bit more and result in a better all-around fuel.

Costs . . . The cost factor is the one which will play a significant part in how the refiner gets his octanes in the future.

Where costs of a processing or the TEL route are equal, the refiner would be inclined to go the lead route since it involves no capital investment. This factor makes the removal of the ceiling an important factor in long-range planning.

On the basis of average blends, increasing the lead content from 3 to 4 cc. in premium grades means the refiner will get his octanes at a cost of around 13c per Research octane number barrel. The regular grades, with their better susceptibility, will give him the octanes at a cost of about 7½ cents per R.O.N.B.

The low figure for regular grade blending and pressure from Detroit for higher housebrand octanes may provide a sleeper of sorts in the entire picture. While lead levels in these grades have been abnormally low in the past 2 years—they dipped as low as 1.48 cc. per gallon the first of this year—a return to the 5-year average of 2.1 is in order.

The low lead content of regular has been due to a combination of factors, including excess downstream processing capacity and surplus refinery runs. If the average climbs back to the 2.1 figure, some plants will be well above this figure in their blends.

A construction slowdown means normal demand will begin to absorb excess capacities. If this is then coupled with an increased demand for higher housebrand octanes—the East Coast is already crowding the 94-octane mark—it could be conceivable that the 3 cc. level will be passed by the housebrands before the premiums make it. This is mainly conjecture, of course, and odds still favor the premiums.

The future of TEL also is tied to supplemental additives which are close to the marketing stage.

Ethyl Corp. has its AK-33X manganese additive and Texaco has its TLA, tertiary butyl acetate additive. Both of these are designed to be used in conjunction with lead to achieve greater octane increases than would be possible with lead alone.

Higher octanes will make these and other additives more attractive in the days ahead and they will influence lead concentrations to a degree.

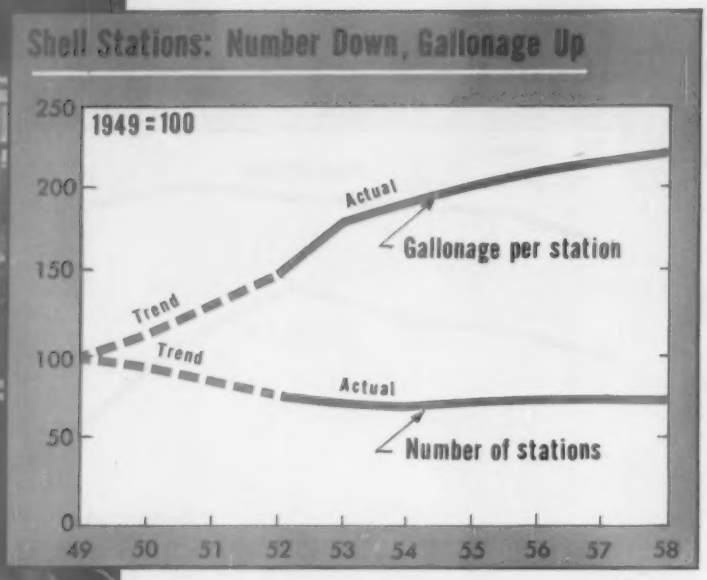
An indication of what's ahead may be contained when Ethyl releases its October gasoline quality survey. However, the true picture probably won't be found until the spring reports start coming out with the pick-up of the motoring seasons.

Meanwhile, the industry has picked up some desired elbow room.

Third-graders, who have had to resort to reblending when individual blends didn't quite measure up, can immediately "touch up" with additional lead.

Those refiners who were hemmed in simply by their limited processing facilities and high premium octanes can now meet the competition by the simply increasing lead levels.

And for the future, the refiners can make their long-range plans with considerably more flexibility.



Shell Has Fewer, Bigger Stations

• Shell has attacked problem of high turnover in service-station operators by cutting down on the number of its stations and stepping up the gallonage. It's paying off for company and dealers.

SERVICE-STATION operation can be one of the most hazardous phases of the oil business. Last year, for instance, one out of every four stations changed hands at least once. One out of 25 changed twice.

The hazards can't be eliminated entirely—but they can be reduced. One of the companies that has made real progress in this direction is Shell Oil Co. In the past decade, Shell has attacked the problem of marginal stations by

. . . **Reducing** the number of its service stations 23%.

. . . **Increasing** per-station throughput almost 120%.

Shell keeps an eye on reports of the Service Station Advisory Committee of the API. One of the functions of this committee is to make a continuing study of service-station turnover.

Forty-two companies with 98,037 lessee stations participated in last year's study. These stations are all company-leased. No jobber stations are included.

Casualty rate . . . It revealed that there were 25,584 terminations (26.1%) in 1958. The first quarterly report for 1959 indicates that the rate will be about the same this year.

The highest casualty rate is among the smaller stations. The API report breaks stations down into three categories: Under 100,000 gal. per year, from 100,000 to 200,000 gal. per year, and over 200,000 gal. per year. The incidence of turnovers last year was, respectively, 42%, 24.4% and 14.1%.

Thus, the chances of a small station folding up are three times as great as those of a large station. While the under-100,000-gal. stations represented only 28.2% of the total, they were involved in 45.3% of the turnovers. The over-200,000-gal. stations were 31.4% of the total and accounted for only 17% of the turnovers.

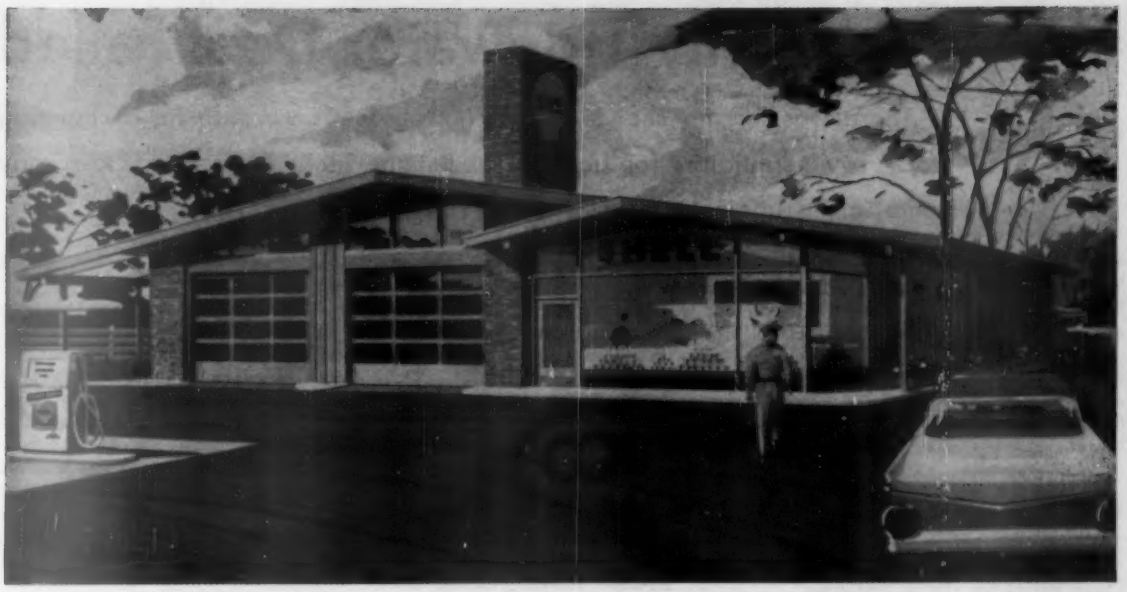
Turnovers are a black eye for the industry, and they are costly. One of Shell's competitors figures it costs $2,000 to obtain and train a lessee. It figures its cost of turnovers at $1,000,000 per year. It also calculates that there is a minimum loss of 10,000 gal. per station with each turnover and that added maintenance because of turnovers costs $100 per year.

There are considerable variations from company to company. This showed up clearly the last time the Senate select small business subcommittee under the chairmanship of Sen. Hubert H. Humphrey (D-Minn.) took a look at New Jersey's perennial price wars.

Shell Oil was among those that testified before the committee. It reported a turnover rate in New Jersey of 13.7%, subsequently reduced to 10.8%. Others that testified on their turnover experience in New Jersey were Gulf Oil Corp. 24%, and Sinclair Oil Corp. 30%.

Shell's strategy . . . Shell's relatively strong market position and better than average experience with turnovers in New Jersey is typical. It did not come about by accident. It is the result of planning inaugurated some years ago and steadily refined and improved since.

Experience of the early depression



A NEW service station for modern residential neighborhoods has been designed by Shell Oil Co. The architecture is ranch-style, and it has a ranch-type fence with flowers. It is designed to complement construction of modern homes. Shell has one of the stations in California, another in Mobile, Ala., and is building one in New Orleans.

years convinced Shell that profitability, and not mere gallonage, is the true test of marketing performance. In the years following 1935, Shell re-examined and trimmed its marketing operations—abandoning areas of low profitability, consolidating depots, and undertaking much larger deliveries to service stations.

The effect of these policies shows up in the accompanying graph. It compares Shell's record in the number of stations and throughput per station for the past decade with its position in 1949. In 10 years, the number of stations in Shell's direct-operated territory has dropped from around 13,500 to about 10,500, and throughput per station has more than doubled.

Here are some of the policies Shell follows in its long-range program of upgrading its service stations:

... **It aims** at a volume of 25,000 gal. or more per station per month.

... **Every station** is expected to earn a profit for Shell and the dealer. Shell does not regard its lessee stations merely as outlets for distribution of its products. Each station is designed to do a balanced business in petroleum products, paid services, and the kind of auxiliary merchandise that the motoring public has come to expect at well-run service stations.

... **Shell looks** on a new service-station proposal as a 20-year investment at the minimum. It regards anything less as shortsighted planning.

... **Shell sells** only to resellers who use the Shell brand, and therefore does not have to face the problems peculiar to dual distribution.

... **Shell's dealers** are given an evaluation test before they are introduced to its elaborate dealer-training program. The company believes that a prospective dealer must have more than just desire and sufficient capital to be a good station operator.

... **Shell believes** in constant modernization of its stations. It doesn't modernize by spurts but keeps at it constantly. Thus, it is never faced with a company-wide, costly, and time-consuming modernization program.

... **It does not look** on service stations as advertising media. Its management contends that a station is a good advertising medium only if it's a profitable operation for the dealer.

... **Shell takes a dim view** of turnpike stations. The company has only six of the 191 toll road stations in the country. It takes a close look at all toll roads but has almost invariably found the required rentals prohibitive. It figures that if the net back is less than the jobber price, it isn't a good deal.

... **Shell has** very few closed stations. It considers stations under reconstruction as closed. Even with this definition, less than .3% of all Shell stations were closed as of August 1. Actually, 90% of the "closed" stations were stations being rebuilt. It regards a closed station as the worst possible kind of advertising, both for Shell and the industry.

... **Shell finds** that higher throughput permits greater deliveries, with a consequent reduction in delivery costs. Some 20 years ago, Shell's average delivery per station was not over 1,500 gallons. The company says it now is almost 3,500 gallons.

None of these policies is inviolate. Exceptions can be and are made. This flexibility enables the company to retain some dealers whose primary justification for continuance is long service rather than large volume. It also enables the marketing department to take calculated risks that would be ruled out if the policies were ironclad.

These policies have helped to give Shell a high rating in the industry in its relations with service station dealers. Shell, for example, is said to have the lowest number of closed stations of all companies.

There are some 10,500 Shell stations in Shell's direct marketing territory now. There are also about 13,000 jobber stations handling Shell products. The company encourages jobbers to follow its programs, adapted to their needs and area.

Shell's approach to the service station problem has paid off for the company and its dealers. It expects even greater dividends in the future when the full effect of the federal interstate highway program is felt.

Why the Skelly-Tidewater Deal Failed

• There was just no chance of getting together on a basis for exchanging stock, say negotiators for both sides. But the idea, while dead now, may come to life again in a few years.

THE billion-dollar merger of Tidewater Oil Co. and Skelly Oil Co. fell apart for one simple reason: Officials of the two companies couldn't come even close to agreeing on the value of their stock.

Skelly felt Tidewater was setting too much store by its "potential"; Tidewater thought Skelly was too much inclined to look at past accomplishments and historical investor acceptance.

This was the tenor of last week's post mortems as the merger proposal was buried for the second time.

They were reminiscent of the first merger failure in 1947. Then Skelly's minority stockholders went to court to block the merger because of concern that the merger basis wasn't fair to them. Similar suits were threatened this time.

Some Skelly stockholders felt they should receive five shares of Tidewater for each Skelly share. Tidewater officials were more inclined to trade 1⅞ Tidewater shares for one of Skelly.

Skelly and Tidewater officials were in agreement last week on one point: The gulf between them was wide at the outset of negotiations, and the two sides got no closer together as time wore on.

George Getty II, who initiated the merger talks 5 months ago, ended them September 17 (OGJ, Sept. 21, p. 115).

"If we had been close, we'd have worked things out," he told the Journal last week. "But we weren't even close."

Not dead yet . . . Despite two unsuccessful attempts in 12 years to merge the companies, Getty indicated another probably lies ahead.

"It won't be tomorrow, though," the Tidewater chief said. But in 3, 4, or 5 years—if Getty's belief in Tidewater's future is vindicated by a solid jump in Tidewater stock in the market—the industry can look for another effort to put the two companies together.

Stumbling blocks . . . There were several specific factors involved in failure of the two companies to get together. Here are some:

. . . Accounting practices. Tidewater uses the LIFO (last in, first out) system for inventories. Skelly uses FIFO (first in, first out).

The result is a conservative net income figure for Tidewater. If Tidewater used FIFO, its net income would jump by $40 million a year, the company said.

There were other accounting differences. Skelly capitalizes dry holes and geological and geophysical expenses. Tidewater charges them off as incurred.

. . . Relative standing in the stock market. Skelly stock is well valued in the stock market; Tidewater's is poorly valued. Skelly stockholders insisted on market value as the controlling factor. Tidewater officials felt the market value of their stock did not represent the appraised value of company assets and did not do justice to its earnings potential.

Getty said Tidewater must blame itself for contributing to the situation in which the market value of its stock is out of line with the company's appraised value. It has failed in its public relations, he said, to the point that the public hasn't realized" what a great change has taken place in the company."

Actually, he declared, Tidewater considers it has "tremendous potential" for future earnings. Income this year, he added, should run between $2.50 and $3 a share.

. . . Intangible factors. Tidewater felt more emphasis should have been given to location of crude-oil reserves.

Its reserves largely are in California and Louisiana where thick pay zones indicate long-lived production. Skelly's are largely in the Mid-Continent and will have a shorter life, Tidewater said. A 10-year projection of the decline curve shows a more rapid drop for Skelly reserves than for Tidewater's, Getty said.

Another important intangible, Getty said, is the shift in emphasis from production to refining and marketing. World conditions, he said, have moved the producer out of the driver's seat and put the refiner-marketer there. In this area, he said, Tidewater held all the cards.

Tidewater's strong position as an integrated refiner-marketer will help the company at least over the next 10 years, while it had been hurt in the

watching WASHINGTON

Clyde La Motte

• The White House says "No" . . .

THE STATE Department has lost its fight to get any substantial change made in the oil import control program.

As a result, not even residual-fuel quotas will be increased during the rest of this year unless an emergency situation develops.

The State Department, unhappy with Interior Department's plan to stand pat at this stage, went all the way to the White House in an effort to get Interior overruled.

State had hoped at least to get an increase in residual quotas. This, it felt, would help assuage the feelings of the Venezuelans who have been seeking equal treatment.

However, the administration feels that the present plan is working reasonably well now and that no major shortages or price hikes are in sight. Therefore, rather than tamper with the program and run the risk of creating fresh problems, it was decided at the White House to let well enough alone.

past 10 years by being short on production. Skelly, Getty said, is in the opposite position with its surplus crude production.

Marketing view . . . Tidewater will not return to marketing in the Mid-Continent, Getty said.

Tidewater sold all of its stations and bulk plants in this area last winter to DX Sunray Oil Co. (OGJ, Dec. 8, 1958, p. 61). This was generally interpreted in the industry as the first step toward a merger with Skelly.

Getty said last week, however, that it had no connection with merger plans. "We couldn't see being an 8,000-bbl. marketer in an area where we had no refining," he told the Journal.

Area of agreement . . . There was agreement on the physical assets of the two companies, Getty said.

One bone of contention initially was valuation of the $200,000,000 Tidewater refinery at Delaware City.

Some Skelly people were inclined to the view that the costly plant was a "white elephant," Getty said. But the refinery now is running 136,000 bbl. daily with only 524 employes, has shown "marked improvement in its earnings," and the eastern division in which it is located is currently the best in the company, Getty told a Los Angeles press conference.

As for the future, said Getty, conditions could change, values could be adjusted, and there's still the possibility that some day negotiations could be resumed.

Second Big Merger Killed

. . . as Texaco halts negotiations with Superior. Antitrust threat blamed for ending what would have been the biggest merger in oil's history.

THE MERGER atmosphere in the oil industry took an abrupt change last week as the second big merger within 2 weeks was called off.

Augustus C. Long, chairman of Texaco, Inc., and William B. Keck, Sr., chairman of Superior Oil Co. of California, jointly announced the companies are dropping their plans to merge. The threat of government antitrust suits was blamed for killing the deal.

The announcement said even though "distinguished" lawyers hired by the companies had cleared the deal of any antitrust complications, the antitrust division of the Justice Department had threatened to file injunction suits against the merger plan if it were carried through.

The demise of the Texaco-Superior deal comes on the heels of an announcement by Tidewater Oil Co. that it will not go through with plans to merge with Skelly Oil Co. (see opposite page).

The Texaco-Superior merger would have been the biggest in oil's history —a $765-million deal.

Long and Keck surprised the oil industry several weeks ago by announcing the merger plan (OGJ, June 29, p. 39).

The Texaco-Superior merger would have involved an exchange of 24 shares of Texaco for each share of Superior stock outstanding. Superior long has had the highest-priced oil stock on the market. In recent years, it has ranged from $1,300 to $2,165. It was quoted at $1,750 a share the day before the merger was called off.

Texaco hoped to beef up its Latin American production by acquiring Superior, which is strictly a producing company.

Superior's biggest property is its Lake Maracaibo concession in Venezuela. The company has developed a healthy field in the middle of the lake. Production has hit as much as 67,000 bbl. daily, but averages about 36,000 bbl. daily. Texaco is comparatively small in Venezuela, with production averaging 50,900 bbl. daily, seventh in the nation.

The Superior merger would also have added to Texaco's record domestic production. Superior produces about 70,000 bbl. of crude daily in the U. S. Texaco is the nation's biggest domestic crude producer with a daily production which averaged 385,867 bbl. last year. However, Texaco's U. S. refinery runs were 598,651 bbl. daily last year.

This may make the Venezuelan problem even more ticklish than it already was.

Venezuela contends that a Western Hemisphere approach is the most logical solution for Western nations to take to assure adequate oil supplies in an emergency. Venezuelans point out that in past emergencies, Venezuela has supplied far more oil than Canada or Mexico.

As the Venezuelans see it, it is unfair and unwise for their country to be placed in the same category with far-off Middle East oil sources.

They also point out that Venezuela is a big importer of a wide variety of U. S. goods, and they threaten trade reprisals if the U. S. oil import plan remains unchanged.

What the Venezuelans would like most would be a U. S. import plan with country-of-origin quotas.

However, U. S. officials have consistently refused to adopt the country-of-origin approach.

• A practical primer in politics . . .

IF YOU'RE interested in becoming more active in politics but don't quite know how to get started, investigate the U. S. Chamber of Commerce's "Action Course in Practical Politics."

This is a nonpartisan course which may be sponsored by your company, your local chamber, or some other organization. It consists of nine 2-hour sessions (usually held weekly or biweekly) covering the fundamentals of party organization from precinct to national level.

• Keeping posted on tax changes . . .

IF EITHER you or your firm is getting into politics, take note of a new rule proposed by the Internal Revenue Service affecting campaign contributions and lobbying.

The proposed change in Section C of Rule 1.162-15 reads, in part:

"Expenditures for lobbying purposes, for the promotion or defeat of legislation, for political campaign purposes (including the support of or opposition to any candidate for public office), or for carrying on propaganda (including advertising) related to any of the foregoing purposes are not deductible from gross income.

"For example, the cost of advertising to promote or defeat legislation or to influence the public with respect to the desirability or undesirability of proposed legislation is not deductible as a business expense, even though the legislation may directly affect the taxpayer's business. . . .

"Dues and other payments to an organization, such as a labor union or trade association, which otherwise meet the requirements . . . are deductible in full unless a substantial part of the organization's activities consists of one or more of those specified (above)."

IRS will accept comments for the next 30 days.

Starting Lineup for Humble of Delaware:

President

Morgan J. Davis

Executive Vice Presidents

Brice

Naden

Reistle

Vice Presidents

Haight

Reeves

Ferguson

Top Posts Filled in Humble Reorganization

THE PRESENT Humble Oil & Refining Co. will hold the top spot in the new Delaware-incorporated Humble company, but two other major subsidiaries of Standard Oil Co. (N. J.) will be strongly represented.

Morgan J. Davis, president of the Texas-incorporated Humble, will be president and director of the new Humble. Top officials of Carter Oil Co. and Esso Standard Oil Co. will hold vice presidencies and directorships.

The organizational plans are subject to approval of a merger of the present Humble company and Jersey Standard by shareholders of the two companies. Shareholder meetings will be held before the end of the year.

Seven men—three from Humble and two each from Carter and Esso Standard—will be invited to serve on the first board of directors of the new company, which is being organized to combine the exploration, producing, manufacturing, and marketing operations of Jersey affiliated companies in the U. S. (OGJ, Sept. 7, p. 96).

Scheduled to serve as executive vice presidents and directors of the new Humble company are: John W. Brice, president of Carter; William Naden, president of Esso Standard; and C. E. Reistle, Jr., currently executive vice president of Humble.

Vice presidents and directors will be: H. W. (Duke) Haight, currently board chairman of Carter and formerly president of Creole Petroleum Corp.; H. W. Ferguson, vice president of manufacturing and marketing for Humble; and E. D. Reeves, Esso Standard's executive vice president.

The board is expected to be expanded once the new company begins its full-scale operations.

"The headquarters staff of the new company will be built up rather slowly," a Humble announcement said, "and in the interim period the directors will use the existing staff personnel of the various operating divisions as far as possible . . . The affiliated companies now operating as separate units initially will continue to operate under their own names, with their own boards and officers, but as divisions of the new Humble Oil & Refining Co.

Oklahoma Scouts Move to Cut Expenses

THE OKLAHOMA scout check has hired a full-time manager and a part-time secretarial staff.

The move is designed to reduce expenses. It will relieve scouts representing 27 companies of at least 1 day's work each week in converting check data into company forms, files, and reports.

Work now duplicated by each of the 27 companies will be handled by the central agency. Scouts will be freed to handle regular scouting assignments.

George Dooley, formerly in the accounting department of Pan American Petroleum Corp. and a former scout, is manager.

A. L. Repecka, Oklahoma City, chairman of an advisory committee representing the 27 operators in the check, said Dooley and his staff prepare reports of wildcats, development wells, make progress reports, and tabulate other information.

The companies each contribute $85 monthly toward the scout check expense, totaling $2,295. This is a reduction from the $125 monthly fee in force 18 months ago when Repecka's committee began its study of scouting practices.

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This New Equipment Combination — "Brown Multiple-String Slips and Elevators"

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With the development of this equipment, Brown Oil Tools remains "OUT FRONT" in well completion tools and services.

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Electric-Rig Controversy Flares Anew

• ASME speakers differ on what is the best way to power a rig electrically. One backs direct-current drive now in use. Another wants changes, including the use of alternating current with torque converters.

NOT ONLY do makers and users of oil-well drilling rigs disagree among themselves about whether rigs should be driven electrically or mechanically, but it now appears there are strongly opposed factions within the proponents of electric drive.

The dissension in the electric-drive camp appeared at last week's petroleum mechanical conference of the American Society of Mechanical Engineers held in Houston.

One faction defends the present direct-current (d.c.) equipment which is almost universally used on electrified American rigs. The other group proposes some radical changes, some involving use of squirrel-cage alternating current (a.c.) motors driving through torque converters.

Spokesman for the a.c. group was W. S. Crake, long-time Shell Oil Co. engineer now assigned to Houston but lately returned from a 3-year assignment at The Hague. Crake also strongly recommended a type of d.c. drive that is new to drilling rigs. Both the a.c.-torque converter and the new d.c. drive are being tried out in Holland by companies associated with Shell. (Crake's complete paper starts on p. 79 of this issue.)

Carrying the d.c. banner was Glenn W. Webb, a drilling-equipment specialist for General Electric at Dallas. The Ward-Leonard d.c. drive now presently used, he said, is still the best suited for rig service, all points considered.

One working . . . Shell has one of the new type d.c. drives already operating in Holland, Crake said. It uses a "ring" system; that is, all generators and motors are connected in series with the same constant current flowing through all. This first unit has been so successful, he said, that a second has been purchased and should be in service soon.

Elements of an a.c. torque-converter drive have also been assembled, Crake told ASME. A pump-drive unit and a drawworks-drive unit have been assembled for the initial trial. If these are successful, he said, an entire rig will be fitted for this type drive. The a.c. system, according to Crake, would be cheaper than others, more reliable, and more flexible.

The a.c. current system could be tapped anywhere to put in new loads, he said, making it truly a "plug-in" drive.

Key to the a.c. system are the high-horsepower torque converters, which at present are available only in Europe. European railroads use engine torque converter drives on locomotives instead of the engine driven d.c. generators and motors common to American railroads. For that reason the big torque converters have blossomed only in Europe.

Cheaper or not? . . . Webb took exception to the claim that an a.c. torque converter rig would be cheaper than the standard Ward-Leonard d.c. drive.

This may be true in Europe, he said, but not here. Moreover, the torque converters are not even available here, nor would be service and parts for them.

The standard d.c. components, Webb said, are mass produced for railroad use here and need be only slightly modified for rig service. This keeps their price competitive with a.c. equipment, especially if expensive torque converters must be added.

It was pointed out d.c. drives need no cooling as does the a.c. torque converter system. Crake conceded the present a.c. torque converter design requires cooling power equivalent of 300 hp.

Webb said that the high starting torque d.c. drive has even made it possible to eliminate most of the shifting transmission from a heavy draw works. The rig, built for Helmerich & Payne, Inc., Tulsa drilling contractors, has just completed assembly at the company's Odessa, Tex., yard.

Conventional transmission has been removed from an Oilwell 96 draw works for this rig. Inside the case where the shifting transmission would have been, one of two driving motors is mounted. The other motor is mounted outside the case behind the driller's position. Only two shafts are needed, Webb said, the drum shaft, and the one driven by the motors. Such an arrangement makes a rig cheaper to buy and to maintain since it has almost no chains nor clutches.

In addition, a similar motor is directly coupled to the input shaft of one of the rig's pumps.

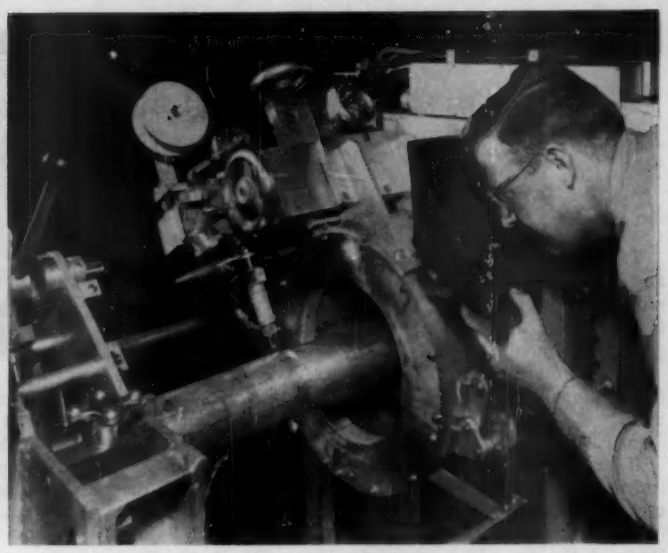
PIPELINE BRIEFS . . .

Contracts for pump-station expansions for Sinclair Pipe Line in Texas have been awarded to Foor Engineering Corp., Oklahoma City. Foor is installing 1,500 hp. at Joy and 2,750 hp. at Files and Willis stations, all on the Sinclair crude system. The projects will be completed by December 15.

Perrault Equipment Co., Inc., has been sold to M. J. Crose Manufacturing Co., Inc., thus combining the facilities of two large manufacturers and marketers of pipeline-construction equipment. Both firms are located in Tulsa.

Plicoflex, Inc., has opened a $1,250,000 plant at Houston to manufacture plastic-based pipeline wrapping tape. The company has moved its headquarters and plant operations from Los Angeles. The new plant will have an annual capacity of 250 to 300 million square feet of tape. In addition to Plicoflex tape, the plant will produce vinyl and laminated film.

A rate of 37½ cents per barrel has been announced by Buckeye Pipe Line for shipment of products from Linden, N. J., to Cleveland through its own line and a connecting carrier. This is competitive with the Laurel Pipe Line between the Philadelphia area and Cleveland. Buckeye moves products from Linden to Macungie, Pa., into the Tuscarora Pipe Line, owned by Esso Standard, which terminates at Midland, Pa., near Pittsburgh. From this point Buckeye com-



ALUMINUM PIPE is positioned for welding on . . . **ALCOA'S** new automatic pipe-welding machine.

New Welding Machine Used on Aluminum Line

ALUMINUM Co. of America believes that its new Unistrength aluminum pipe is now feasible for major use in pipeline construction.

The company last week completed laying a 4,500-ft. 8-in. line as part of a gas-gathering system at its Point Comfort, Tex., operations.

In laying the pipe, Alcoa used its new automatic pipe-welding machine for the first time and buried the lightweight pipe without any protection of wrapping or coating. Alcoa says its seamless pipe has efficient welded joints because of a heavier wall thickness at pipe ends. The thinner wall along the pipe length cuts weight and lowers cost. Nominal wall thickness at pipe ends is 0.322 in., while along the length it is 0.204 in.

The welding machine is the first that produces sound welds with full penetration without using back-up rings, Alcoa says. It completes a pass on 8-in. pipe in 17 seconds. Alcoa installed a 20,000-ft. bare aluminum pipeline through sand, gumbo, and salt marsh at Point Comfort 2½ years ago, and the company says it has given low-cost service because of its high resistance to corrosion.

The earlier pipe was the same thickness throughout, while the new Unistrength pipe, with thicker ends, is designed to compensate for loss of strength due to welding. Before, the thickness required for strength at the weld dictated the wall thickness throughout the joint.

Alcoa says cost of the line is about 4% higher than a steel line of comparable size.

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pletes the shipment to Cleveland through its own line. Buckeye this summer increased by 33% its capacity through the 16-in. Linden-Macungie line.

A 22-mile 6-in. products line is being taken up and reconditioned from Dayton to Springfield, Ohio. Inland Corp. is handling the project with company crews. It will be completed October 15.

A 16-in. aluminum pipeline will be installed next month by Superior Oil Co. in a fire-protection system in the Altagracia area of Lake Maracaibo, Venezuela. It's believed to be the largest-diameter aluminum line ever installed and was chosen for corrosion resistance. The line will have a capacity of 2,000 gal. per minute of water. Reynolds Metals Co. supplied the 0.250-in. plate from which pipe will be rolled and welded by Graver Tank & Manufacturing Co., Inc., East Chicago, Ind.

A 59-mile 16 and 20-in. lateral from the main line near Vancouver, Wash., to extend natural-gas service to Salem, Ore., is planned by Pacific Northwest Pipeline Corp. The project hasn't been scheduled as yet. Pacific has completed gathering lines in Big Piney, Wyoming, field and is laying field lines in Piceance Creek, Colorado, to be completed November 30.

A 41-mile 24-in. loop of a supply lateral starting near Rayne, La., has been approved by FPC for Columbia Gulf Transmission. The temporary authority will enable Columbia to construct the $3,916,000 line in Vermilion and St. Mary parishes.

Also for Pipeliners . . .

IN THE NEWS: Alcoa says new automatic welding machine will make its aluminum pipe feasible for major pipeline construction (p. 55) . . . FPC modifies its ruling in the famous Transwestern case and sets date for a price hearing (p. 56) . . . Natural Gas Pipeline protests Texas new gas tax (p. 61).

A complete list of pipeline projects is carried on p. 113.

PLUS THIS TECHNICAL REPORT: Proving systems for P.D. meters (p. 100).

FPC Modifies Ruling in Transwestern Case

• Prices will be reconsidered, provided producers commit their reserves in advance, commission says. Transwestern still hopes for early start on construction.

TRANSWESTERN Pipeline Co. and its suppliers have won important modifications of a Federal Power Commission ruling which they appealed last month.

And producers have a new chance to convince FPC that initial prices called for in their contracts with Transwestern are not too high.

If producers agree by October 23 to commit their reserves to Transwestern, in advance of the price rehearing, then construction can proceed. Price of the gas will be fixed finally by the commission after hearings to be set at a meeting October 27.

If producers won't agree in advance to commit their reserves, then the project is off, a Transwestern spokesman said. But the price hearing itself will have no bearing on the project's future. Once reserves are committed, Transwestern will be in a position to build the 1,809-mile system.

In a ruling August 10, the FPC ordered cuts of 1 to 6 cents per M.c.f. in most of the contracts. Last week FPC granted producer requests for a rehearing, and also made these modifications by producers and Transwestern:

. . . It deleted a provision requiring producers to waive their right to put higher rates into effect under bond pending a rate-hike hearing.

. . . It changed its take-or-pay provision. Under the new order Transwestern must pay for all gas contracted for, whether it takes it or not. The new order also provides that Pacific Lighting Co. must pay for at least 91% of the gas it contracts to buy, regardless of the amount it takes.

. . . It gave Transwestern more time. Originally Transwestern was given only 6 months to complete its facilities. Now it will have a year from the time a certificate is granted.

. . . It permitted Transwestern to eliminate from its proposal facilities to take gas from Cities Service Gas Co. Cities Service canceled its contract after the August 10 FPC ruling.

Early start? . . . Transwestern officials last week said they still hope to begin construction immediately.

All that is needed, they said, is producer acceptances of the FPC requirements that gas reserves be committed to the project before final prices are determined. "We hope to get these within a week," one Transwestern executive said.

Split vote . . . Despite the new lease on life the producers got from last week's atcion, it is far from certain that they will succeed in getting the price cuts restored.

There are still sharp differences of opinion on the commission, even over the matter of granting the rehearings. Commissioner William R. Connole dissented on reopening the proceedings, saying he saw no point in giving producers "a chance to prove once again what they have already failed to prove."

Commissioner Arthur Kline was in agreement with Connole except, he said, possibly on the price Transwestern had agreed to pay Gulf Oil Corp. The other prices, Kline said, "far exceed any previously contracted prices in either the Panhandle or West Texas areas."

Because the proposed prices are higher than existing prices, Kline said, "only clear proof that the price conditions we imposed will result in confiscation would cause me to modify that opinion."

In view of these opinions by Connole and Kline, the producers obviously will have to pin their hopes on convincing the remaining three commissioners that higher prices are justified.

Changes Urged in Louisiana's Depth Allowable

THE STATE of Louisiana was challenged last week to become "the most progressive state in oil and gas conservation by modifying its depth allowable formula and encouraging wider well spacing.

E. B. Miller, Jr., Houston, chairman of the Oil Industry Conservation Forum and a vice president of Tidewater Oil Co., said Louisiana has saved the oil industry many millions of dollars with its spacing laws but that the depth allowable must be increased as well.

Miller spoke to the thirty-seventh annual meeting of the Louisiana-Arkansas division of the Mid-Continent Oil and Gas Association.

The forum which Miller heads is interested in conservation, particularly wider well spacing.

"Wider spacing is meaningless to the operator unless he can increase the per well allowable sufficiently to compensate him for not drilling an additional well on less space.

"The operator is currently faced with a minimum annual rate of depletion of his reserves. Unless means are provided for him to maintain or increase this rate of reserve depletion, he will have no interest in wider spacing."

Expensive trend . . . Miller cited the following example to show the comparative return on investment of a few years ago and today:

From 1950 to 1953, an 8,500-ft. well was allowed to produce 235 bbl. daily in Louisiana. Today its allowable is 81 bbl. daily. Assuming the well cost $115,000, the producer in 1950-53 has 2.04 bbl. of production for each $1,000 invested, while today he has only 0.70 bbl.

In Texas, using the same comparison, production has been cut from 99 bbl. to 43 bbl. and return on each $1,000 invested has dropped from 0.86 bbl. to 0.37 bbl.

"How long can the industry endure this trend?" Miller asked. "If my arithmetic is correct, the industry could drill one-third as many wells and be allowed to produce three times as much oil per day per well, and it would be in about the same position it was in 1953."

"It is my personal opinion that the State of Louisiana could become the most progressive state in oil and gas conservation if some modification of the depth allowable formula which would encourage wider spacing could be adopted for future development."

Miller recalled that the state conservation department started a study several years ago to determine whether a better formula could be developed—"but nothing ever came of it."

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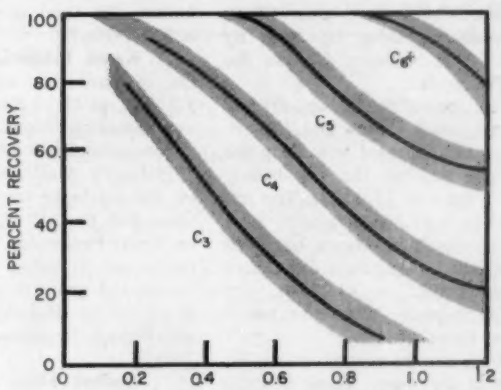
- Dryex adsorption gasoline plants are complete including fractionation and refrigeration equipment which yield NGAA specification products.



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Alaskan Depth Record Set

. . . by Union-Ohio wildcat on the Kenai Peninsula. Several other deep tests are drilling or planned in Alaska.

ALASKA boasted a new drilling-depth record when Union Oil Co. of California passed the 14,374-ft. mark recently with its Union-Ohio Kenai Unit wildcat on the Kenai Peninsula.

The well, located 6½ miles south of the town of Kenai, took over the depth record from the 1 Bear Creek Unit abandoned earlier this year by Humble Oil & Refining Co. on the Alaska Peninsula.

The new record holder was drilling ahead last week below 14,781 ft. Union has not revealed how deep the wildcat will go, but the rig drilling the hole is rated at 15,000 ft. The test is located on a 61,468-acre unit.

One other well in Alaska has gone below 14,000 ft. Standard Oil Co. of California drilled a 14,221-ft. dry hole on its Swanson River Unit, which also is on Kenai.

Operators are busy at several other locations in the state. These include:

. . . Iniskin Bay. Alaska Consolidated Oil Co. is drilling below 10,900 ft. on 1 Antonio Zappa across the Cook Inlet from the Kenai Peninsula.

. . . Cape Yakataga. Richfield Oil Corp. is putting the finishing touches on roads to its drill site for 1 Kaliakh River at Cape Yakataga on the coast of the Gulf of Alaska. The Clyde Hall Drilling Co. rig has been unloaded at Cape Yakataga.

. . . Nulato. Roads are also being built to the site of Paul G. Benedum's 10-12,000-ft. test slated for the Nulato area in the Koyukuk Basin of west-central Alaska. The site is 16 miles southwest of Nutalo. The Mountain States Drilling Co. rig was waiting at Nulato for final moving to the site in SW 7-10s-2e.

. . . Kenai Peninsula. Standard Oil Co. of California was drilling below 9,230 ft. on 32-15 Swanson River Unit and redrilling below 5,320 ft. on 12-27 Swanson River Unit.

Halbouty Alaska Oil Co. is waiting on the rig being used on the Union-Ohio test to drill its second wildcat on Kenai Peninsula. This second Halbouty test, 1 Bishop Creek Unit, will be located about 9 miles west of the first well, 1 Halasko King Oil Co. which was abandoned last May at 12,037 ft.

. . . Susitna Flats. Anchorage Gas & Oil Development Co., Inc., is drilling below 1,200 ft. on 4 Rosetta in the Susitna Flats region 15 miles north of Anchorage.

. . . Alaskan Peninsula. General Petroleum Corp. is moving a rig to drill its second test in the Lake Becharof region on the Alaska Peninsula. This second effort will be about 14 miles from the recently abandoned 11,080 ft. 1 Great Basins.

No Resid Shortage

. . . seen by Carson. So, no quota revision is likely during last half.

IMPORTS Administrator Matthew V. Carson made it plain last week that he does not foresee any residual fuel shortages and that, if any should occur, they could be met quickly.

That apparently puts an end to further government consideration of any upward revision in residual fuel import quotas during the last half of this year.

The OIA released figures showing that 9,672,713 bbl. of residual was imported into Districts 1-4 during August, 14.5% of the total allocation for the 6 months ending December 31. In July, 11.7% of the total was imported.

In the 4 months remaining, importers have a total quota of 40,335,-194 bbl.

He also announced that licensed imports of crude and unfinished oils, finished products, and residual oil totaled 1,392,293 bbl. daily in the U. S. and Puerto Rico during August.

In Districts 1-4 the totals were: crude and unfinished oils, 655,346 bbl.; finished products, 80,273 bbl., and exempt imports of crude oil from Canada, 51,014 bbl.

In District 5, the August figures were: crude and unfinished oils, 261,-014 bbl.; finished products, 11,230 bbl., and exempt imports from Canada, 48,923 bbl.

PROCESSING

A high bid of $126,000 was submitted at the sale of the bankrupt Queen City Oil & Refining Co.'s 1,500-bbl. plant at Dickinson, N. D. The offer was submitted by a group of four men headed by Edmund Hollstein, Rushville, Neb., former Queen City president. Others were C. K. Dedros and two former Queen City directors, J. M. Kennedy and Andrew Ploog. No decision was made on accepting the bid.

A 1,300-bbl. alkylation unit will be added to Midland Co-Op's 11,850-bbl. refinery at Cushing, Okla. Completion is set for the middle of 1960. Procon, Inc., is the contractor.

Florida Oil & Refining Co., subsidiary of Frontier Refining Co., has

Allowable Boost Is Rejected

. . . for huge SACROC water-flood project. Similar request for another Texas unit now before Railroad Commission.

AN INCREASED allowable for one Texas pressure-maintenance project has been turned down while a second is pending before the Texas Railroad Commission.

Rejected was SACROC Unit's request for a big hike in the MER in Kelly Snyder field. Still awaiting commission action is an increase sought for Goldsmith San Andres field.

SACROC, currently the world's largest unitized water flood, had asked for an increase to 190,000 bbl. per day from the present 154,812 bbl. per day.

James B. Thomas, unit chief engineer, told the commission at an August hearing that the unit had injected more fluid than it had produced ever since the program was started in September 1954. He said the unit had the capacity to continue to overinject with the higher MER proposed. It planned to do this, he said, in order to improve pressure distribution through the reservoir.

SACROC, he said, now has injected 223,641 bbl. of water (to July 1, 1959) since water input started 5 years ago.

Cumulative oil production, since the field discovery in November 1948, stood at 234,777,433 bbl. Of this volume, 110,963,442 bbl. was produced since the pressure-maintenance program was launched.

Before the start of the line-drive, center-to-edge type flood, the field had dissipated half of its original bottom-hole pressure while producing only 4.37% of its original in-place oil.

Now, Thomas said, oil production has reached 7.9% of that originally in the Canyon Reef pay while pressure has been pushed back up to about 61% of the original level.

Thomas said SACROC calculates the pressure-maintenance program during the past 4½ years has prevented the loss of roughly 80,000,000 bbl. of stock tank oil.

The denied MER hike was the second sought by the unit since it started operations. It was more successful in early 1956 when a similar increase was approved.

Goldsmith pending . . . Meanwhile, the commission still had not ruled on another large allowable hike sought by Gulf Oil Corp. for Goldsmith San Andres field in Ector County, West Texas.

Gulf, operator of the Goldsmith San Andres Unit, applied in August for an increase in per-well allowables to a conditional 88 bbl. per schedule day rather than the current 73 bbl. daily.

Any operator in the field injecting fluids in excess of his total fluid withdrawals from the reservoir would earn the higher allowable.

Ira Butler, attorney for Gulf, said reservoir pressure has not only been maintained but increased from 1,007 to 1,107 psi. since the program started. Pressure now is 307 psi. higher than it would have been if primary production had been continued, Butler said.

The Goldsmith unit takes in 576 wells and 18,240 acres of the field's 1,076 wells and 30,700 acres. To June 1, 1959, the unit area had produced a total of 97,645,246 bbl. of oil since discovery in 1934. Another 56,000,000 bbl. has been racked up by wells outside the unit area.

The unit pressure-maintenance program was launched in October 1952. It involves water injection through 40 inputs wells around the unit periphery and gas injection through four wells near the center of the unit area. Injection water, which was pumped into the San Andres at an average rate of about 50,000 bbl. daily in 1958, comes from water wells in the 3,700-ft. Hendrick reef near Wink, Tex., through a 31-mile pipeline to Goldsmith.

Operators in the nonunitized area of the field are cooperating in a program to inject produced gas back into the reservoir's north gas cap. Gas now is being reinjected through 46 input wells.

As of the first of 1959, these operators had injected 80 billion cubic feet of gas. During 1958, Gulf reported, they reinjected 47% of all gas produced in the nonunit area.

BRIEFS . . .

purchased a deepwater refinery site at Jacksonville, Fla. Florida Oil & Refining plans to build a 10,000-bbl. refinery at Jacksonville (OGJ, July 27, p. 112).

A vacuum flashing unit is under construction at Texaco Canada's Montreal East refinery. The new equipment will produce feedstock for a catalytic cracking unit as well as bunker fuel oil. With a diameter of 26 ft. and weighing 140 tons, the vacuum tower will be one of the largest in Canada.

Shell's cycling plant at Little Creek, Miss., is expanding its gas capacity from 4 million cubic feet to 11 million cubic feet per day. The addition of two compressors and extension of the gas-gathering system will permit additional wells in the field to be placed on gas lift. The plant now extracts 14,000 gal. of liquid daily.

Construction is nearly half completed at Sohio's new acrylonitrile plant at Lima, Ohio. First product test runs are expected in early 1960. The new plant will convert propylene and anhydrous ammonia to acrylonitrile in a single step.

Ethylene capacity will be expanded by 35,000,000 lbs. a year at Phillips' Sweeny, Tex., petrochemical complex. Expansion is now under way and will raise the plant's annual capacity to 290,000,000 lbs. when completed in 1960.

Also for Refiners . . .

IN THE NEWS: Esso workers at Baton Rouge give tank a delicate aerial ride through refinery with two big cranes (p. 44) . . . Lifting TEL barrier won't mean sudden spurt in use of lead (p. 46) . . . Shell finds it more profitable to reduce number of service stations but build them larger (p. 48) . . . Seven top posts filled in Humble reorganization (p. 52).

PLUS THESE TECHNICAL REPORTS: LPG underground storage capacity up 15% in year (p. 75) . . . How Humble rates its gas turbine (p. 88) . . . Process Costimating (p. 96).

Only a paint brush and solvent cement are needed to join Butyrate pipe.

Thanks to its light weight, pipe of Tenite Butyrate is easy to handle.

Pipe of Tenite Butyrate plastic means less downtime

As any oilman knows, metal flow lines carrying high paraffin crudes can completely plug in a very short time. Result: costly maintenance plus the loss of valuable production time.

Nearly ten years ago, some enterprising oilmen decided to do something about this problem and began to use pipe of Tenite Butyrate plastic for their operations. The inner wall of this pipe has an extra-smooth surface that discourages the accumulation of paraffin.

Since then, millions of feet of Butyrate plastic pipe have been installed by the petroleum industry. Users report many benefits.

Here's pipe that resists paraffin plugging

Butyrate pipe is virtually non-corrodible. It withstands the attack of sour crudes, salt water, and alkali soils.

Butyrate pipe gives greater flow volume. Smooth walls mean less load on pumps.

Butyrate pipe is tough. It can take rough handling and all normal backfilling operations.

Butyrate pipe is light. A 20' length of 4" pipe weighs only 20 lbs.

Butyrate pipe is easily joined. You just solvent-weld slip-sleeve couplings to the pipe ends. Any cutting can be done with an ordinary hand saw.

Couldn't this pipe be of help to you, as it has been to other oilmen for nearly a decade? Write us for additional information and the names of companies that produce the pipe and a complete range of fittings. Address: EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

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A 16-mm. sound-color film, "PLASTIC PIPELINES," is available upon request.

Air-Drilling Records Shattered, ASME Told

• Drillers are licking many early problems of air drilling. Crooked holes now look like the biggest headache.

ENGINEERS attending last week's petroleum mechanical conference of ASME got some startling revelations about air drilling.

Included were these items:

. . . **A well in Terrell County, Texas,** is currently air drilling below 17,000 ft., almost 3,000 ft. deeper than the previous record.

. . . **Another well in the same** area was blown dry of mud in a single stage from 14,400 ft.

. . . **Air-drilling rates** using a hammer drill have been as much as six times as high as with conventional air drilling.

. . . **The silicon tetrafluoride** gas treatment has been successful shutting off water in about 75% of West Texas field trials.

Reporting these important developments to ASME was F. W. (Smokey) Smith, general manager of Technical Drilling Service, Midland, Tex.

Smith said about 3% of all hard-rock drilling is done with air or gas instead of mud as the circulating fluid. By the end of 1961, he predicted, perhaps as much as 30% will be done with air or gas.

In discussing the deep air-drilling job, Smith said that a big problem has been the tensile strength of the drill string. There is no flotation with air in the hole as there would be with mud. This fact makes it questionable, he said, just how much past the present 17,000-ft. depth the hole could safely be air drilled with the drill string in use.

Smith said that air drillers are much encouraged by the success of the silicon tetrafluoride gas treatment for water shutoff in air-drilled holes. This Gulf Research & Development Co. technique, he said, will make it possible to extend air drilling economically into many more wells.

Actually, Smith reported, water in the hole is not the biggest air-drilling headache. Biggest problem, he said, is crooked hole. Where beds dip steeply, it has been necessary to use extra big drill collars (as big as 8-in. o.d. in 8¾-in. hole) fitted with a reamer immediately above the bit and a stabilizer 30 ft. up. Even with this "packed hole" arrangement, it has sometimes been necessary to resort to very light weights on bit.

In extreme cases, he said, badly crooked hole has caused high drill-string torque and even twistoffs while drilling keyseats.

There has been speculation that the hammer drill would help out in bad crooked hole country, he said. It hasn't been tried, however, in such a situation. It has been tried in routine drilling with results little short of spectacular.

There is still development work to be done on associated equipment, Smith said, before the hammer could be recommended for general use in air drilling.

Texas' New Gas Tax Headed for Court Test

NATURAL-GAS pipeline companies are making noises indicating they will not accept Texas' new "severance beneficiary" gas tax without a fight.

B. M. Britain, Amarillo attorney, said last week that the tax will be attacked in court next month when first payments come due.

Britain represents Natural Gas Pipeline Co. of America and others.

The Amarillo attorney predicted that all of the so-called long lines will file suit in October. "They would be silly not to," he said.

The new tax, to be paid by the first purchaser of produced gas at a rate of 1½% of value, took effect September 1. The first payment, on September sales, is due in October. Suits contesting validity of the tax can not be filed until protesting firms have filed their reports on September gas production and paid the tax under protest.

The new gas tax, passed in July, was one of the prime bones of contention during an exhausting legislative year which saw Texas lawmakers struggle fruitlessly through a general and two special sessions before finally passing a record tax bill during a third special session.

The gas tax, which would bring in an estimated $7,800,000 annually, was knocked down and revived at least half a dozen times before it finally passed. Much of the opposition was based on arguments that it would be attacked in court by pipelines, proved unconstitutional, and the needed revenue thereby lost.

With strong support from Gov. Price Daniel, however, a tax was finally pushed through.

Purchaser May Be Forced to Take Crude

THE TEXAS Railroad Commission may decide soon whether it can order a common purchaser of crude in Texas to buy oil it doesn't want.

Byron Hoffman, a San Angelo independent, has filed a request for a special hearing of a case in which this issue is apparently drawn.

Hoffman will seek relief under the commission's broad, far-reaching pipeline order of June 1958.

The agency promised the San Angelo operator an early hearing.

The Hoffman situation, a highly unusual one, involves a producer who has had a pipeline connection for a well for several months, but has been unable to sell any production from that well.

The well, Hoffman told the commission, is the discovery well of the B. & H. Queen sand field of Crockett County, West Texas. Operator is Hoffman Brothers and J. H. Buchanan.

No sales yet . . . The wildcat, Hoffman said, was completed in October 1958, and has been shut in since that time. It is 6,000 ft. east of Halff field and 5,700 ft. west of Clara Couch field.

The Hoffmans and Buchanan are major operators in Halff. They built and paid for the gathering system in this field. The system is operated by Texas-New Mexico Pipeline Co. and the oil is bought by Texaco, Inc. The company laid a line from the B. & H. field discovery well and connected it into the gathering system following the wildcat's completion. Texas-New Mexico, Hoffman said, also operates this line. Texaco, however, will not buy this oil, he said.

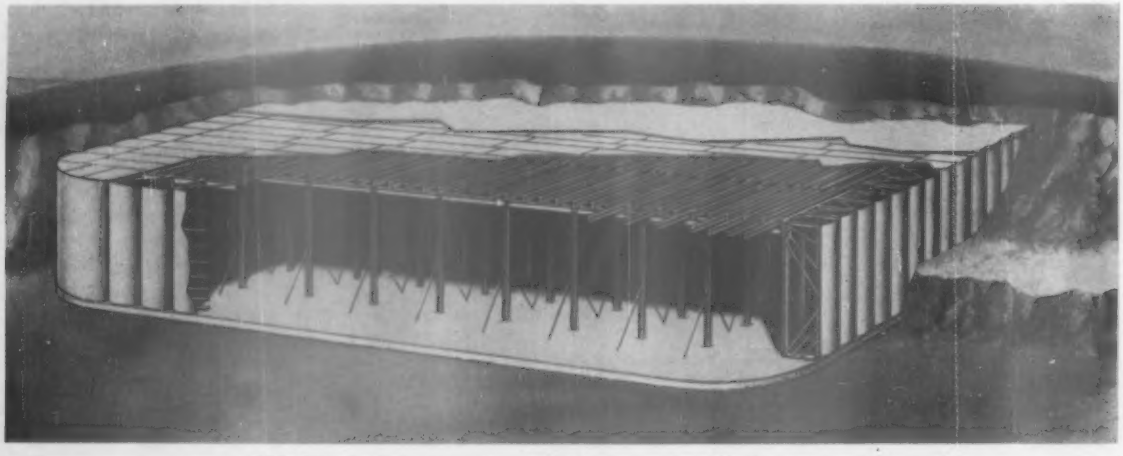
Giant Portable Rig

WORLD'S largest truck-mounted rig—the Ideco Desert Rambler built by Ideco, Inc.—is on its way to North Africa.

The rig, purchased by Camdrill International, Inc., will be used in Libya by Oasis Oil Co.

The 127-ft. mast will tower 145 ft. above the desert sands in working position. The major components of the rig are mounted permanently on five heavy-duty semitrailers equipped with huge sand tires.

Major items of equipment on the rig include the mast, an H-525 Hydrair hoist powered by two V-12 diesel engines, a Mud-Master 600-hp. slush pump powered by another Caterpillar D-397 engine, a combination electric plant, workshop, and traveling warehouse.



Unique Tanks

DEPARTING from conventional designs, curved shell plates are being used in construction of four storage tanks being built by Chicago Bridge & Iron Co. for Greater New York Terminal, Inc. The curved sidewalls, reinforced by stiffeners, lessen the weight and lower stress level of the 5-million-gallon tanks. The bottom of the tanks will be 7 ft. below ground level. The roof of each tank will be covered by concrete 4 in. thick, and the tanks will then be covered with mounds of dirt.

Power Plus

THE MOST powerful engines ever developed for pipelines—that's the way Clark engineers describe their new TPV engines. The giant crankshaft of the new two-cycle V-type gas engine is shown above. The 10-cylinder turbocharged unit will drive a centrifugal compressor on the Columbia Gulf Transmission Co. gas line—a pipeline industry first for a two-cycle engine. The 10-cylinder model is rated at 4,000 hp., and the 12 and 16-cylinder engines of this new TPV series will be 4,800 and 6,400 hp.

Britain's Biggest

AERIAL view shows Britain's largest oil tanker, "British Queen," leaving the slipway after being launched by the queen mother at Clydeside yard of John Brown & Co.

The 50,000-dw.-ton tanker, owned by BP Tanker Co., is 760 ft. long, 97 ft. wide, is driven by steam turbines, and has a loaded speed of 15½ knots.

The tanker is equipped with the latest navigational equipment, including radar, radio direction finder, V.H.F. radio telephone, and echo sounder.

It even has a swimming pool on the aft boat deck.

Product Stocks Way Over Industry Desired Level

Stock—	Desired Levels* Projected to 9/4/59	Actual Storage as of 9/4/59	Above or Below Desired Levels
Crude	256,800,000	251,900,000	— 4,900,000
Gasoline	163,300,000	181,500,000	+18,200,000
Kerosine	29,300,000	31,400,000	+ 2,100,000
Distillate	132,100,000	163,200,000	+31,100,000
Residual	45,700,000	57,500,000	+11,800,000
TOTALS	**627,200,000**	**685,500,000**	**+58,300,000**

*Based on figures presented to the Texas Railroad Commission in March as to desired stocks on April 1 and November 1.

Texas Keeps Output Low

- **Railroad Commission pulls surprise by keeping a 9-day allowable, which is 45,719-bbl.-daily cut for October.**

SEVERAL major crude buyers were scrambling actively for crude in Texas last week following the Texas Railroad Commission's surprise retention of a 9-day allowable for October.

October thus will become Texas' fourth straight 9-day month. Applied to a 31day month, it will trim 45,719 bbl. daily off the allowable in effect September 5.

The commission's action, which will mean an initial October allowable of 2,714,862 bbl. per calendar day, upset the forecasters' dope bucket. At least 10 days, and perhaps 11, had been predicted on the basis of steadily declining crude stocks.

The commission's decision to cut, however, was based not on low crude stocks but on burgeoning products storage. Figures considered at the hearing showed product stocks as of September 4 totaling 433,600,000 bbl. —more than 63,000,000 bbl. above levels indicated by the industry's economists last March as desired for this time of year.

Company after company expressed concern at the hearing over excessive products levels. J. G. Coates of Gulf Oil Corp. termed them "alarmingly high." John Harris of Phillips Petroleum Co. called them "dangerously excessive."

Despite this, only two firms, Phillips and Indiana Oil Purchasing Co., sought 9 days. Eight asked for a 10-day pattern, while Humble Oil & Refining Co. and Texaco, Inc., nominated on an 11-day schedule.

Humble's Charles Shaver said it was doubtful that his firm could fill its crude needs on less than a 10-day pattern. Humble's stocks, he said, are below minimum working levels. Shaver said the company had been forced to turn down a sale of 20,000 bbl. of crude daily when able to buy only 83,000 bbl. daily of a needed 100,000 bbl. extra in September.

ALLOWABLES BY DISTRICTS

District—	October	Change from Sept. 5
1. Southwest	51,033	— 400
2. Gulf Coast	105,490	— 2,168
3. Gulf Coast	354,253	— 5,781
4. Southwest	184,606	— 3,079
5. East Central	31,963	— 469
6. Outside East Texas field	112,813	— 2,194
6. East Texas field	130,842	— 3,335
7-B. N. Central	162,284	— 1,714
7-C. W. Central	130,503	— 2,379
8. West Texas	1,037,124	—23,263
9. North Texas	259,375	— 1,313
10. Panhandle	154,576	+ 376
TOTAL	2,714,862	—45,719

Regulatory enigma . . . Commission members grilled buyers closely as to the effects of the various possible allowable schedules on individual company situations.

They took pains also to feel the pulse of those few independents present and testifying at the hearing.

William J. Murray, Jr., commission member, noted that the commission finds itself in a perplexing situation.

If the commission should increase the allowable, he said, refiners would almost certainly continue to refine the crude at excessively high rates thus causing physical waste and purchaser proration. If it should cut the allowable, Texas might well lose still more of its crude market to other states, Murray said.

"For some months we have been above the proper level for crude and, by painful reductions, have brought crude storage below the desired level. But products are now far too high. And the commission has no control over products. This poses a perplexing problem: Shall we look at products? It looks like we'll have to.

"The other perplexing problem is that Texas is losing more of its share of the market as gaged by reserves. That is of concern. A number of companies have nominated for an increase. If we refuse them, we may have failed to help Texas recapture its share of the market. If we do not, it will further increase products stocks. How do we answer this without getting into physical waste and purchaser proration?"

Independent switch . . . E. L. Wilson, spokesman for a group of Dallas independent operators, said he had come to Austin authorized to go along with an allowable increase based on independents' feelings that the situation had improved.

Wilson said testimony at the hearing, however, had convinced him they were wrong, that an October increase isn't justified, and that the low allowable should be held for another month.

It seems that no one, Wilson said, can control refinery vice presidents except by keeping crude away from them.

Oklahoma increases . . . The Oklahoma Corporation Commission last week voted to increase the state's October allowable.

Production will be on a 17-bbl.-daily basis instead of 14 bbl. which has prevailed the last 3 months.

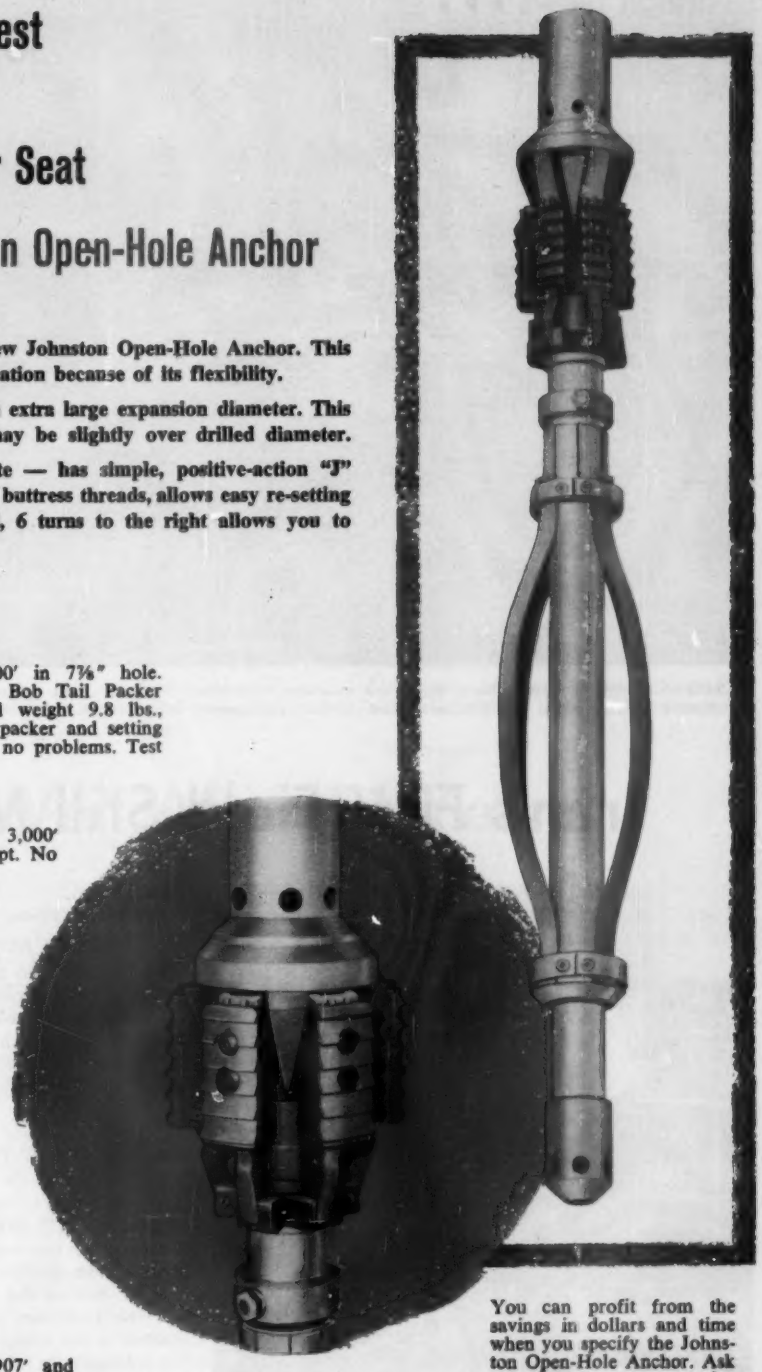
Commission Chairman Ray C. Jones said the increase was ordered because for the last 3 months' production has been less than purchasers' nominations and the same situation was expected for October unless the allowable was increased.

Purchaser nominations totaled 520,050 bbl. daily for October. Production for first 12 days of September under a 14-bbl. allowable averaged 500,843 bbl. daily.

The October nominations were 13,395 bbl. daily greater than those for September. Bulk of the increase came from two buyers: Kerr-McGee Industries, Inc., with 7,000 bbl. daily more, and Indiana Oil Purchasing Co., with 5,000 bbl. more. Both have ended purchaser proration in the state.

To Open-Hole Straddle Test
Eliminate Tail Pipe
Insure a Good Packer Seat

specify the new Johnston Open-Hole Anchor



Many advantages are offered with this New Johnston Open-Hole Anchor. This is a slip-type device which has wide application because of its flexibility.

The slips are designed and built to give an extra large expansion diameter. This insures seating in wells where the hole may be slightly over drilled diameter.

The Open-Hole Anchor is easy to operate — has simple, positive-action "J" setting. A spring locking nut, incorporating buttress threads, allows easy re-setting of the anchor. When testing is completed, 6 turns to the right allows you to rotate out of the hole.

THE PROOF---

Hansford County, Texas
Conventional test at 8800′ in 7⅞" hole. Used Anchor and single Bob Tail Packer only. No tail pipe. Mud weight 9.8 lbs., estimated 120,000 lbs. on packer and setting tool. No slipping of tool, no problems. Test successful.

Hansford County, Texas
Straddle test in 7⅞" hole between 3,000′ and 4,000′. Anchor set on first attempt. No wash pipe used. Test successful.

Hansford County, Texas
Straddle test in 7⅞" hole between 6,000′ and 7,000′. Tool set on first attempt. No wash pipe used. Test successful. Second test run between 5,000′ and 6,000′. Packer failed to seat in washed out hole. Moved up hole, tool and packer set on first attempt.

Hansford County, Texas
Straddle test in 7⅞" hole between 5,000′ and 6,000′. Tool set on first attempt. No wash pipe used. Test successful.

Liberal, Kansas
Straddle test between 5,006′ and 5,016′. Tools worked well. No trouble. No wash pipe used. Test successful.

Liberal, Kansas
Selective zone tests between 3,907′ and 3,915′ and 4,672′ and 4,680′. No problems encountered. Tools worked perfectly. No wash pipe. Test successful.

Liberal, Kansas
Two straddle tests run between 4,662′ and 4,678′ and 4,577′ and 4,614′. Both tests O.K. No trouble whatsoever. Tools worked as expected. Test successful.

Eliminates the need for tail pipe on conventional tests and straddle tests.

Offers flexibility in finding packer seat. If seat is not obtained on initial attempt just pick up and re-set the tool.

You can profit from the savings in dollars and time when you specify the Johnston Open-Hole Anchor. Ask your Johnston representative for full information. You'll be glad you did.

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P.O. Box 98, Houston 1, Texas

MASJID-I-SULAIMAN field where Iran's oil industry was born 51 years ago is in the rugged foothills of the Bakhtiari Mountains. Oil brought the desolate area its first permanent inhabitants.

Iran's First Field Still Making Nearly

NATIVE worker at field's 75,000-bbl. topping plant breaks up solidified sulfur in a drying unit adjoining the sulfur-recovery unit.

Paul Swain
International Editor

AS LONG AS there has been an oil industry, those who look for the elusive crude on which the industry is founded have cursed Mother Nature for the inhospitable spots she put petroleum. Iran didn't start this philosophy, but it might well have.

Iranian oil might have picked a more difficult birthplace than Masjid-i-Sulaiman, but it would have been an effort.

Today it's hard to imagine how G. B. Reynolds and the other D'Arcy Exploration Co. pioneers ever manhandled a rig into the area, much less made the discovery that put ancient Persia on the oil map. Until the oil men came, the MIS area was uninhabited except for a few herdsmen in the winter months. No one in his right mind would have considered living in this region of Iran during the rest of the year.

The field lies in a series of long, narrow, irregular valleys in the range of foothills that blend into the Bakhtiari Mountains of southern Iran. For a brief period in the spring the area bursts into bloom with wild flowers literally carpeting the valleys. The rest of the time it is barren and burned brown.

Those early oil seekers were attracted to such an inhospitable place by the oil seeps that had been known for centuries. Seeps don't make an oil field, and it took 7 years of activity before the D'Arcy group brought in the discovery May 26, 1908.

Since that first bit churned into the prolific Asmari limestone and a surge of crude topped the small derrick by more than 50 ft., more than 250 wells have been drilled in the field, 3.5 miles wide and 12 miles long.

MOST OF IRAN is a pipeliner's nightmare and Masjid-i-Sulaiman is no exception. Lines snake all over the field, but mostly up and down.

IRAN'S discovery well was drilled May 26, 1908. The well capped 7 years of exploratory work. Note the Moslem mosque to the right of the well.

2,000 Bbl. a Well After 51 Years

Today the 51-year-old field accounts for 37,000 bbl. daily of Iran's production, but only from about 20 wells.

The field area was first called Maidan-i-Naftun, "field of oil," but more than 30 years ago it officially became Masjid-i-Sulaiman from the ancient ruins of Solomon's temple which can still be seen near the air strip that serves the oil camp.

The climate at MIS hasn't changed any in the last 51 years. The hillsides are still just as desolate looking as they were before oil was found. But, the region is now heavily populated. Iranian Oil Exploration & Producing Co., the international consortium's successor to the old Anglo-Iranian Oil Co., has almost 5,600 employes there. All employes but 223 Europeans and Americans are Iranian. The oil field and the money it has brought have given birth to a score of settlements in the area.

In addition to serving as operating headquarters for the one field, MIS is still headquarters for all the producing fields and exploratory work done by the consortium in Khuzistan. It is from his office at MIS that J. J. O'Brien, tall, genial general fields manager for the company, keeps an eye on producing operations at Agha Jari, Lali, Naft Safid, Haft Kel, and Gach Saran, which account for more than 900,000 bbl. daily.

Venezuelan Oil Strike Is Short Lived

THE YOUNG Venezuelan Government has shown that it meant business when it said it would not tolerate labor strikes in the oil industry at the present time.

President Romulo Betancourt ended a strike against Richmond Exploration Co. after 1 day by ordering 450 workers back to their jobs. Swift action in the isolated dispute made it clear that the government is determined to take a firm stand, if necessary, in the current industry-wide negotiations for a new labor contract.

The labor scene has been further disrupted by a walkout of 150 workers at Halliburton de Cementacion y Fomento, a local service company. The strike arose over the reinstatement of a dozen workers, the removal of a crew forman, and the acceptance of findings of a labor ministry commission. Company and worker representatives, the national union, and the labor ministry are discussing a solution.

The Richmond dispute arose over hiring procedures when the California Standard subsidiary refused to hire a boiler foreman for each of its shipping stations in Boscan field. The stoppage shut down operations at the field and at Bajo Grande refinery. Venezuelans who tried to enter through the closed gates of the company's Maracaibo office were questioned by strikers with pieces of pipe wrapped in newspaper.

The labor ministry said the strike is legal, but the president has authority to order strikers back to work and set up arbitration machinery in cases where the national economy is endangered. President Betancourt said the country cannot afford a strike.

Richmond workers returned to their jobs, pending arbitration of the dispute within 30 days. But the local union is protesting by refusing to appoint anyone to the arbitration committee.

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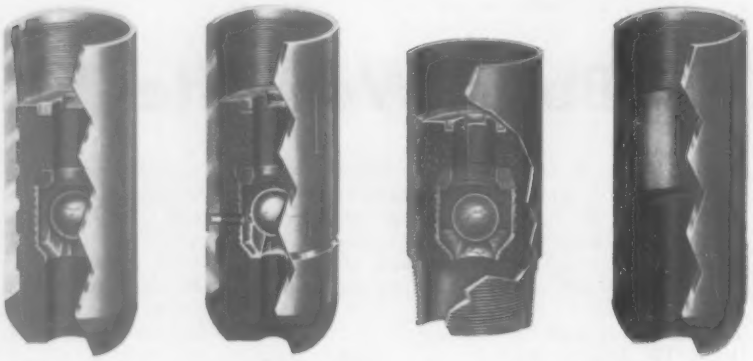

FIG. 302 FIG. 322 FIG. 401 M&F FIG. 202

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LARKIN LEADERSHIP HAS BEEN EARNED BY YEARS OF DEPENDABLE PERFORMANCE

Russians Gain Bigger Share of Foreign Markets

• Soviet exports up 32% since last year. Increase in crude shipments greatest, but products also show gain. At the same time, Russian imports are dropping.

DESPITE a widely held opinion that Russian exports will not be an immediate threat to world markets, Soviet shipments of oil to foreign customers are rapidly growing.

Official figures issued by the USSR Ministry of Foreign Trade show that Russian crude and products exports last year jumped to 18.1 million tons, or about 362,000 bbl. daily. This is a gain of 32% in one year.

The biggest rise was in crude. Exports rose to 182,000 bbl. daily, a gain of 54%. Shipments of 180,000 bbl. daily in products was a smaller, 15% increase.

The Soviets have been shipping an increasing share of their crude production into foreign markets. Total exports of crude and products last year were equivalent to 16% of Russian production. In contrast, 1956 exports were equal to 12% of production, and in 1957 equal to about 14%.

Biggest customers of Soviet crude last year were Czechoslovakia, East Germany, Hungary, United Arab Republic, and Italy. Largest products buyers were Red China, Poland, United Arab Republic, Sweden, Finland, West Germany and France.

A breakdown was not immediately available on shipments of crude and products to individual countries last year. But in recent years exports have been rising to both free world and Communist bloc countries, with Communist countries taking a bigger share of the total.

In 1955, Albania, Bulgaria, China, Czechoslovakia, East Germany, Hungary, North Korea, Mongolia, Poland, Romania, and Vietnam took 40% of crude and products exports totaling 160,000 bbl. daily.

In 1956, the bloc took 42% of exports totaling 200,000 bbl. daily, and in 1957 took 54% of 274,000 bbl. daily.

Russia's own imports have been declining. Crude imports last year fell to 21,600 bbl. daily from 26,600 bbl. daily in 1957, and 30,200 bbl. daily in 1956.

Product imports were 64,600 bbl. daily last year, against 58,700 bbl. daily in 1957, and 76,000 bbl. daily in 1956.

Russians Test New Drill

RUSSIA says it has successfully field tested a new combination turbo-rotary drill.

The method combines rotary and turbo drilling by using two bits at the same time. A smaller bit is at the bottom of the hole driven by a turbo drill. A reamer bit of larger diameter is further up hole, turning with the drill pipe by rotor power.

Because each bit has increased power per unit of rock area, the Russians say they obtained exceptionally high penetration speed.

A new national drilling record of 198 ft. per hour was set in a well in the Zyr district of Baku in a try out of the method. In the first 52 hours of drilling, including various supplementary operations, the crew made 3,408 ft. of hole. The well is still drilling ahead of a projected depth of 16,400 ft.

FOREIGN BRIEFS . . .

An 800-ft. extension to North Pier at Ras Tanura terminal has been opened by Arabian American Oil Co. The $3.8-million extension has increased the length of the pier to 2,160 ft. Two new berths brings the total to 10 enabling the Persian Gulf terminal to more efficiently handle loading capacity of more than 1 million barrels daily.

A new field being developed on the northern end of Sakhalin has the best crude, from the point of view of light ends, of any field on the Pacific island. Russia says the discovery, 1 Mukhto, was completed at 5,136 ft.

A wildcat in Portuguese Timor has been abandoned at a depth of 6,755 ft. The well, the 1 Ossulari, was apparently located on the flank of a geological structure. Tradewinds Exploration, Denver, is moving the rig and expects to begin at a new site in about 2 weeks.

A polystyrene and saran plant will be built at Ribecourt, near Paris. Pechiney S.A.A., French chemical and electro-metallurgical firm, will join Dow Chemical International, Ltd., S.A., to form a new company, Plastichimie, S.A., to operate the plant. Construction will start later this year, and operation is scheduled for 1961. Pechiney operates a polystyrene plant at Ribecourt which will become a part of the new plant.

Mobil International will enter the gasoline market in Puerto Rico within the next 60 to 90 days. The new expansion program will be carried out by Mobil Oil Caribe, Inc., with headquarters in San Juan. The company intends to establish a network of service stations of ultra-modern design, eventually covering the major gasoline-consuming areas of the island.

More refining capacity is being added in West Germany this month with the start up of a 20,000-bbl.-daily plant by Purfina at Duisburg. The Petrofina affiliate expects regular production to begin in October. Crude is being supplied through the new 28-in. Wilhelmshaven-Cologne pipeline, in which Purfina holds 8.3% interest.

Hopes are fading for Australia's first offshore wildcat. The well, 1 Humber Barrier Reef, was bottomed at 1,898 ft. The well is located on Wreck Island, off Queensland. Test found reef limestone overlaying sandstone. There were no shows.

A 2,300-bbl. refinery at Salzbergen, West Germany, is being expanded by Wintershall, AG. with the addition of a new 2,000-bbl. crude unit. The unit is being designed to run naphthene-based crude from Cabimas field in Venezuela. It will go on stream near the end of next year. The plant now handles local paraffin-based crude.

Sixth hydrofiner built by the British Petroleum group has been commissioned at Porto Marghera refinery, near Venice, owned jointly by BP and AGIP. The 6,500-bbl. unit is of BP design, and has an adjacent sulfuric acid plant.

An 8-year-old exploration program in Sicily is being given up by British Petroleum, which is renouncing its licenses. The move follows similar action by BP in Malta.

Philippine Tests

. . . indicate commercial oil in strike near Cebu City.

AN APPARENT commercial discovery in the Philippines has yielded 35 bbl. daily on a flow test through a ⅛-in. choke (OGJ, Sept. 21, p. 122).

The flow test was made from one of the horizons which had earlier yielded high-gravity clean oil on initial tests. The well was drilled 30 miles west of Cebu City on Cebu Island by Republic Resources & Development Corp.

The crude appeared to be waxy, and if the find proves to be the country's first commercial field, some modification of processing equipment will probably be necessary before local refineries can handle it.

The flow test is believed to have been made of a sand at 1,257-84 ft.

These had yielded 50 ft. of heavy oil and gas-cut mud, and 754 ft. of high-gravity free oil on an earlier test. A test of sands from 1,107-90 ft. had yielded 449 ft. of clean 41°-45°-gravity oil. Total depth is 1,335 ft.

A microlog showed 35 ft. of possible productive sand. Cores on the whole reportedly look good.

Some of the samples had a coarse-grained, subangular, gray sandstone with quite a bit of quartz, and there appeared to be a considerable amount of fine, clayey, or ashy, cementing material. Initial measurements showed 26% porosity.

When present tests are completed, the rig will be moved 50 ft. east for the first stepout. This will be taken to a lower depth in search of more sands and at least one limestone section.

Egyptian Well Sets Record

THE BIGGEST producer so far drilled in Ras Bakr field on the Egyptian mainland has been brought in by General Petroleum Co.

The government-owned company said Bakr 14 tested 520 tons, or about 3,800 bbl., daily through a 2⅜-in. choke from a 110-ft. zone between 2,490-2,600 ft. Four oil-bearing zones were found in the well, which was bottomed at 3,408 ft.

The rig has been moved to No. 15 location, and a new German-made rig is being set up on a site 2,300 ft. south of No. 14.

Field development at Ras Bakr and Kireim, another new field a few miles south, is being hurried to enable commercial production to start in December or January. The fields are expected to average 20,000 bbl. daily. Ras Bakr 14 is the field's ninth producing well.

Pakistan Refinery Planned

A 30,000-BBL. refinery will be built at Karachi by a group of four companies.

California Texas Co., Standard-Vacuum Oil Co., Burmah Oil Co., and Royal Dutch-Shell plan to open the $31-million plant in the summer of 1962. The design will enable expansion to 40,000 bbl. daily capacity later.

Under an agreement with the Pakistan Government, the companies will hold 60% interest. The remaining 30% will be sold locally in a private subscription. Pakistani and foreign representation on the board will be proportional to interest held.

The plant is expected to supply about three-fourths of domestic demand for gasoline and save $6.5 million a year in foreign exchange.

Lube Plant Set for Chile

A NEW lubricant-blending plant being built at Vina del Mar, Chile, will be operated by a new joint company formed by Mobil International Oil Co. and its Chilean distributor of lubricants, Cia. de Petroleos de Chile (Copec).

The new company, Mobil Oil de Chile, Ltda., will open the $975,000 plant later this year with an initial capacity of 78,000 bbl. per year, which can easily be doubled. A 10-in. pipeline will be laid 400 ft. offshore and connected to buoys, where tankers will discharge blending stocks.

Copec's marketing network and other interests are not included in the new company. But further expansion of the jointly held company is envisaged.

Germans Buying More Crude

WEST GERMAN crude imports rose 62.4% the first half of the year, as output from new refineries edged product imports out of local markets.

Foreign crude purchases of 314,000 bbl. daily accounted for about three-quarters of total imports of 417,000 bbl. daily. Products, which accounted for the remaining purchases, last year amounted to one-third of total imports. Imports of fuel oil the first half were down 8%. Diesel oil was down 69.3%, and motor gasoline, off 39.2%.

Sudan Concession

. . . granted U. S. firm. The acreage is along Red Sea.

GENERAL Exploration Co., Los Angeles, has been granted a concession by the Republic of Sudan covering 1.4 million acres along the coast of the Red Sea. Operations in Sudan will be run by a subsidiary, General Exploration Co. (Sudan) Ltd.

The prospecting licenses are the first granted a U. S. company by Sudan. Both onshore and offshore areas are involved. The licenses adjoin a block the same size granted ENI, the Italian Government's oil agency.

ENI is following up acquisition of its concession in Sudan with negotiations for rights in the White Volta Valley in Ghana, West Africa, and for permits in the Herzegovina region of Yugoslavia.

The company is shipping three rigs from Italy to Egypt, where they will be on call for drilling in Sudan.

Refinery proposed . . . Royal Dutch-Shell and British Petroleum Co. are offering to build a refinery in Sudan that would cover the country's entire needs.

If the government accepts the proposal, the plant will be built at Port Sudan on the Red Sea coast. A site survey would start soon after the offer was accepted. Consumption in the country is now about 9,000 bbl. daily.

Shell has received permission to send a geological reconnaissance party into northwest Sudan. The survey will cover about 185,000 sq. miles and take 4 or 5 months.

Pure Quits in Paraguay

PURE OIL CO. has suspended exploration operations in Paraguay after four dry holes.

There are no immediate plans for further drilling. But the company and its partners in the venture are retaining an interest in three million acres of the original 14-million acre concession. Others in the group, for which Pure Oil has been operator, are Gulf Oil Corp., Sinclair Oil Corp., Tidewater Oil Co., and Williams Brothers Corp.

The program had been especially arduous, even for the oil industry. A 260-mile road was built, most of it through dense forest, and nine airports were opened. On at least two occasions outlying parties had to fight off raiding Indians.

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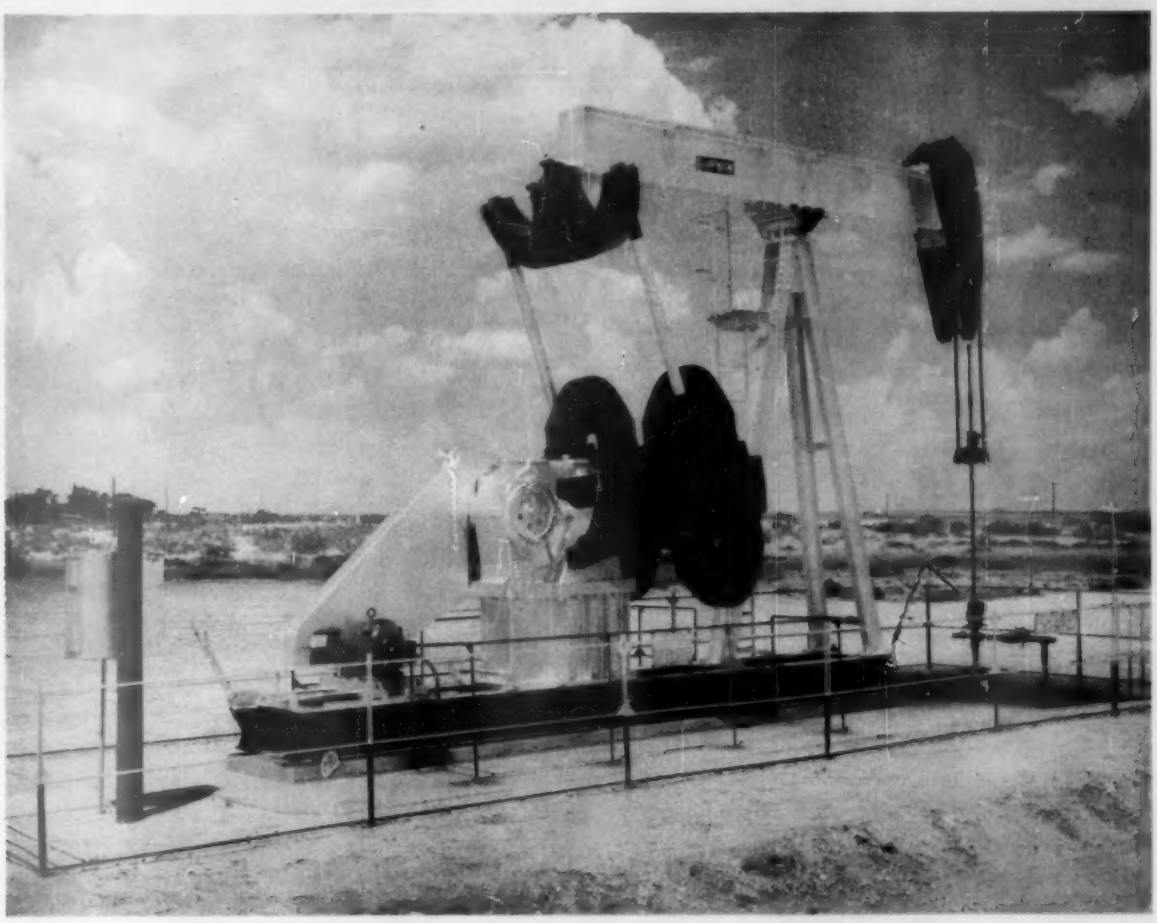

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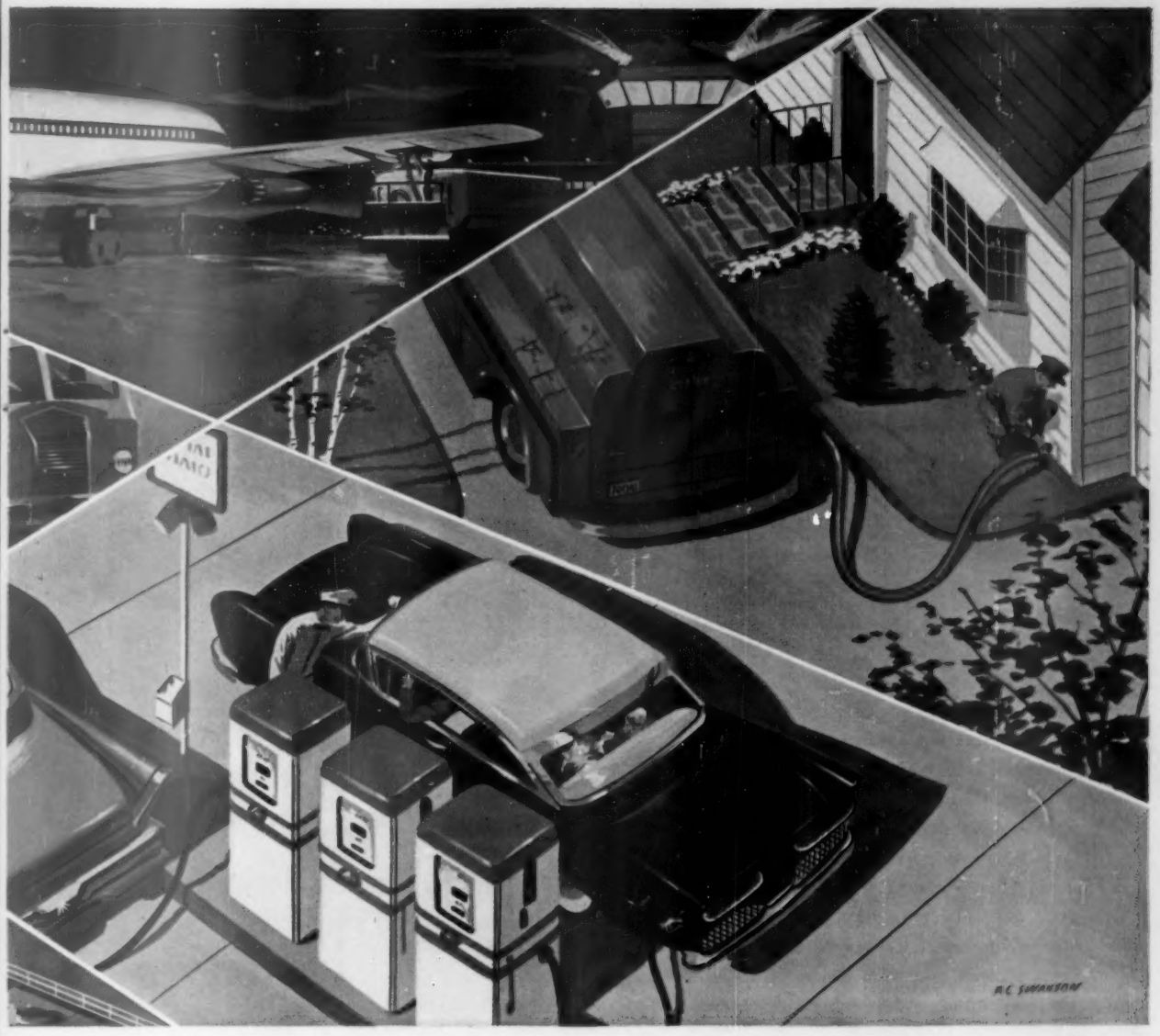

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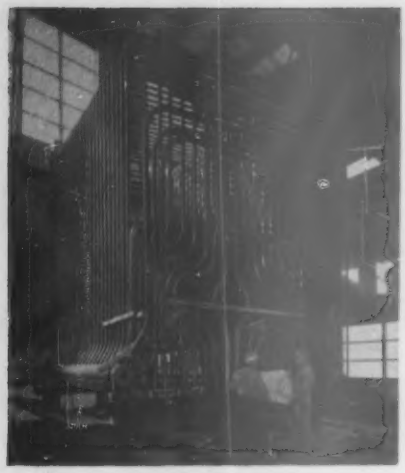

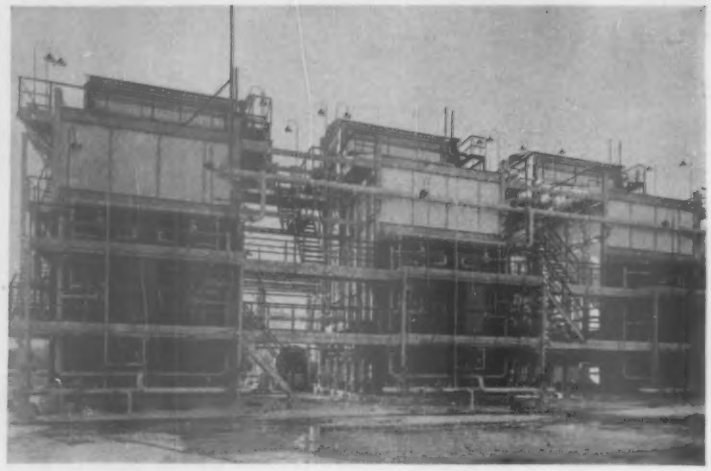

AT LEFT: Installing a 60,000 lbs/hr unit in a brewery

ABOVE: A battery of 125,000 lbs/hr units in a chemical plant

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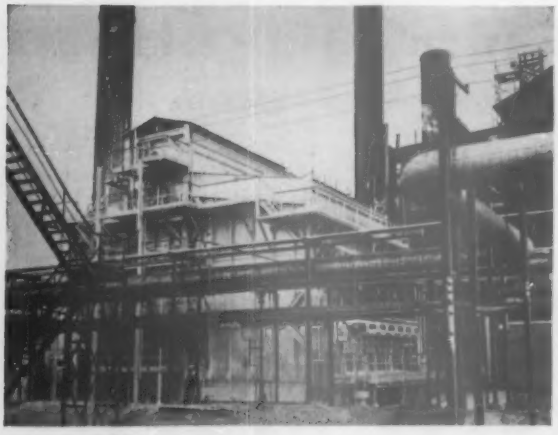

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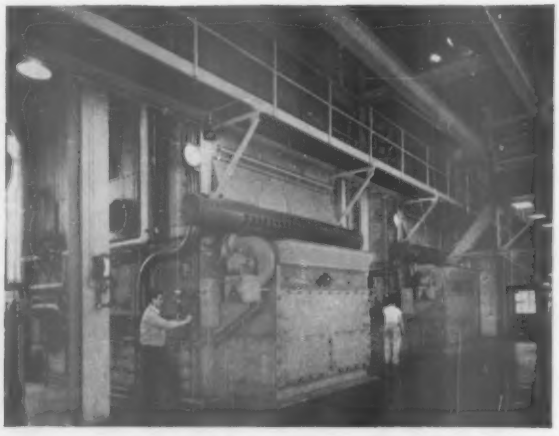
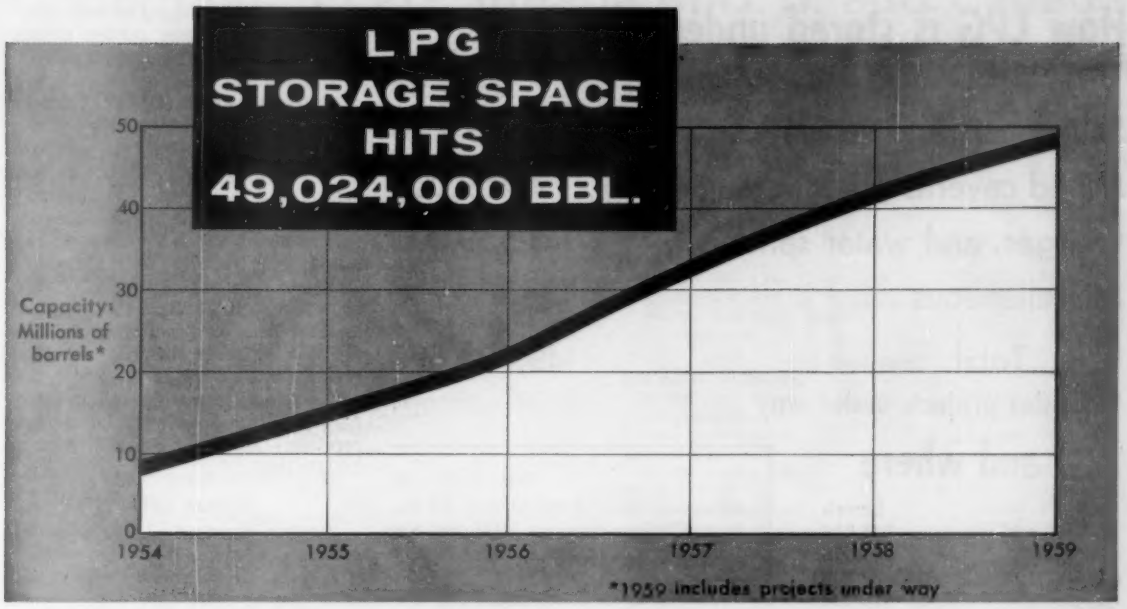


Three 40,000 lbs/hr units serve a medical center



LPG underground storage capacity jumps 15% with actual storage in U. S. at record level on eve of big winter season. Eleven new projects are under way or planned. Three new states and Alberta have been added to picture

BY ROBERT B. BIZAL
Director, Editorial Research

THE INDUSTRY is busy developing more underground storage space to take care of the fast-growing LPG market.

Capacity in the United States has climbed to 49,024,000 bbl., counting the projects which are currently under way and scheduled for completion within a year. This is an increase of 15% since last year, and three times greater than the 1955 capacity.

This abundant storage space is being used this year as never before. As summer was ending, actual LPG and LRG stored underground throughout the nation topped 24,400,000 bbl. The previous prewinter storage high was in 1957, when actual underground storage hit 18,500,000 bbl.

Just how fast this year's record inventory will be pulled down depends a great deal on the severity of winter.

This year's annual storage-capacity survey by The Oil and Gas Journal shows that storage projects have spread to three new states, Nebraska, North Dakota, and Montana, as well as Alberta in western Canada.

The trend toward more mined caverns continues in the U. S. The survey shows that 11 new projects are under way or planned, including four mining jobs. One is being carved out of solid granite, and another out of solid limestone for the first time.

New Projects

The latest project is a mined cavern near Omaha. The Metropolitan Utilities District of Omaha, a municipal gas and water utility firm, has just started construction of a cavern mined from shale and limestone. It will hold 150,000 bbl. of propane for peak shaving when completed late next year.

The biggest development project now under way is Texas Eastern Transmission Corp.'s program to set up storage at both ends of the Little Big Inch products line.

At the Texas end of the line just east of Houston, Texas Eastern is developing 1,000,000 bbl. of propane, storage capacity in a washed-out salt dome. Each of two wells will be able to handle 500,000 bbl. One well will be ready in November, and a second will be completed in March 1960.

At the other end of the line at Todhunter terminal in Ohio, Texas Eastern recently began injecting propane in its newly mined shale caverns.

Three caverns have been completed, a fourth will be ready in November, and a fifth will be completed in February 1960. The five mined caves will give Texas Eastern total capacity of 835,000 bbl. at Todhunter.

Here is a brief rundown of some of the other important projects under way, recently completed, or planned.

... The first all-limestone cavern in the U. S. is now under way at Shell Oil Co.'s big 175,000-bbl. refinery at Wood River, Ill.

Fenix & Scisson, Inc., Tulsa, con-

The cover photo of this issue shows a tunnel near Middletown, Ohio, which is part of Texas Eastern Transmission Corp.'s Todhunter terminal at the northeast end of the Little Big Inch products line. When completed next February, the storage area will have a capacity of 835,000 bbl. of propane.

How LPG is stored underground* . . .

	Bbl.
Salt domes and salt layers	40,707,750
Mined caverns (shale, granite, etc.) . . .	4,459,000
Oil, gas, and water sands . . .	3,550,000
Miscellaneous	307,940
Total	49,024,690

*Includes projects under way

. . . and where

	Barrels
Alabama	365,000
California	600,000
Georgia	87,700
Illinois	926,000
Kansas	2,740,000
Kentucky	290,000
Louisiana	3,848,000
Maryland	45,240
Michigan	1,005,000
Mississippi	2,250,700
Montana	60,000
Nebraska	150,000
New Jersey	675,000
New Mexico	808,000
New York	820,000
North Dakota	150,000
Ohio	895,000
Oklahoma	333,000
Pennsylvania	700,000
Rhode Island	200,000
Texas	31,976,050
Wisconsin	100,000
TOTAL	**49,024,690**

*Includes projects under way.

tractor for the job, said that building a cavern in limestone creates no special problem, except that it's more difficult to find impermeable limestone sections.

This storage area will hold 400,000 bbl. of butane after completion in mid-1960. The stored butane will be used in gasoline blending.

. . . **First granite storage** for LPG in the U. S. is being built by Sun Oil Co. at its Marcus Hook, Pa., refinery. The first of three caverns has already been completed and holds 250,000 bbl. of butane. Another will hold 250,000 bbl. of propane, and a third 200,000 bbl. of butane when completed by mid-1960.

Sun is also washing a salt-layer in Wayne County, Michigan, which will ultimately hold 100,000 bbl. of butane. Current capacity is 25,000 bbl. Sun has four other caverns in that area.

. . . **North Dakota's first LPG** storage project started in August. Dakota Salt & Chemical Co. is building an evaporative salt plant and LPG storage depot on a 600-acre site at Williston. The parent company is General Carbon & Chemical Corp., Lake Forest, Ill.

The first year, storage capacity will amount to 150,000 bbl. and will gradually be increased. Several wells are being drilled to the Spearfish and Charles salt formations found at about 7,000 and 8,500 ft. The area will be capable of holding 2,000,000 bbl. within the next 5 or 8 years.

Brine from the washed-out caverns will be sent to the evaporators at the salt plant. The plant will initially produce 50,000 tons per year of high-purity salt.

The depot's storage caverns are a "natural complement to the salt manufacturing operation," an official of General Carbon & Chemical said.

The storage depot will be available on a fee basis to all bulk distributors of propane, butane, and petroleum hydrocarbons in the U. S. and Canada. Segregated storage caverns can be assigned to large users.

. . . **Magnolia Petroleum Co.** will develop two salt-dome storage projects for ethylene in Liberty County, Texas. Each will hold 250,000 bbl. when completed. The company already operates a huge salt-dome storage cavern there, capable of holding 2,100,000 bbl. of butane and propane.

. . . **Montana's first LPG storage** project is being developed by Texas Natural Gasoline Corp. The salt-layer storage can handle 60,000 bbl. of propane and is a part of a natural-gasoline-plant facility in Wibaux County.

Also under way is the Texaco, Inc., salt-layer project in Beaver County, Oklahoma. It will hold 33,000 bbl. of propane. In Hockley County, Texas, Pan American is developing new facilities to hold butane. El Paso Natural Gas Co. plans to develop two new salt-layer formations in Lea County, New Mexico, to store butane and propane. Ultimate capacity will be 100,000 bbl.

Canada Active

Western Canada's LPG underground-storage capacity is growing.

Alberta Underground Storage Co. is developing a salt cavern at Hughenden, Alta., about 125 miles southeast of Edmonton. Current capacity is 143,000 bbl., with ultimate capacity of 430,000 bbl.

The firm is now alternately washing the two completed wells to increase capacity, and is drilling a third well for cavity No. 3. The company is owned by British American Oil Co., Ltd., Canadian Hydrocarbons, and Goliad Corp.

In Saskatchewan, Steelman Gas, Ltd., has present capacity of 140,000 bbl. at its project at Melville. Ultimate capacity in this salt layer will be 400,000 bbl.

Sales Soar

The relatively cheap underground storage of LPG has become a most important factor in stability of the fast-moving LPG industry. It provides a firmer supply and a more stable flow during peak winter months.

And compared with aboveground steel-tank storage, it's very inexpensive. Storage in washed-out salt formations is the most popular and is generally considered the least expensive, but this type of formation is not always where you want it. That's why the industry is turning more and more to caverns mined at depths of several hundred feet in shale, limestone, chalk, and granite.

Sales of LPG and LRG have been increasing steadily in recent years. In 1958 sales climbed to more than 177,000,000 bbl., an increase of 7½% over the previous year.

This year will show another big gain. Sales the first 6½ months were more than 12% greater than during the same period, and production was up nearly 18%.

Reprints Available

Reprints of this exclusive survey are available at 50 cents each. Address Reader Service, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

Underground LPG Storage in U. S. and Canada

Company County and type of storage	Capacity (in bbl.)	Product
Alabama		
Tuloma Gas Products Co.—Sinclair Oil & Gas Co.		
Marengo—Mined chalk	140,000	B-P mix
Marengo—Mined chalk	225,000	Propane
California		
Standard Oil Co. of California		
Los Angeles—Water sand	150,000	Propane
Los Angeles—Water sand	150,000	Butane
Los Angeles—Water sand	100,000	Propylene
Sunray Mid-Continent Oil Co.		
Los Angeles—Oil sand*	200,000	Propane
Georgia		
Atlanta Gas Light Co.		
Various counties—Buried tank†	87,700	Propane
Illinois		
Phillips Petroleum Co.		
Kankakee—Mined shale	260,000	Propane
Shell Oil Co.		
Madison—Mined limestone (under construction)	400,000	Butane
U. S. Industrial Chemicals Co.		
Douglas—Mined shale	170,000	Propane
Warren Petroleum Corp.		
Kane—Mined shale	44,000	LPG
White—Mined shale	52,000	LPG
Indiana		
Northern Indiana Public Service Co.		
La Porte—Mined shale (project indefinitely postponed)		Liq. pet.
Kansas		
Cities Service Oil Co.		
Reno—Salt layer (4 caverns)	235,000	Butane
Reno—Salt layer (6 caverns)	490,000	Propane
National Cooperative Refinery Association		
McPherson—Salt layer (4 caverns)	200,000	Propane
McPherson—Salt layer (14 caverns)	675,000	Butane
Pan American Petroleum Corp.		
Grant—Salt layer (7 caverns)	180,000	LPG
Phillips Petroleum Co.		
Kingman—Salt layer (4 caverns)	250,000	Butane, propane
Skelly Oil Co.		
McPherson—Salt layer	460,000	Propane
Tuloma Gas Products Co.		
Reno—Salt bed	250,000	Propane, butane
Kentucky		
Columbia Hydrocarbon Corp.		
Greenup—Mined cavern	210,000	Propane
Greenup—Mined cavern	80,000	Butane
Louisiana		
Cities Service Refining Corp.		
Cameron—Salt dome	600,000	Normal butane
Cameron—Salt dome	630,000	Propane
Continental Oil Co.		
Calcasieu—Salt dome	100,000	Propane
Esso Standard Oil Co.		
Ascension—Salt dome	170,000	Butane
Ascension—Salt dome	165,000	Isobutane
Ascension—Salt dome	330,000	Propane
Ascension—Salt dome	250,000	Propylene
Ascension—Salt dome	475,000	Ethylene
General Gas Corp.		
Bienville—Salt dome	238,000	Propane
Bienville—Salt dome	100,000	B-P mix
Petroleum Sales, Inc.		
Evangeline—Sale dome	200,000	B-P mix
Evangeline—Sale dome	75,000	Propane
Evangeline—Salt dome	60,000	Butane
Warren Petroleum Corp.		
Bienville—Salt dome	300,000	LPG
St. Landry—Salt dome	155,000	Propane
Maryland		
Washington Gas Light Co.		
Montgomery—Buried tanks†	45,240	Propane
Michigan		
Cities Service Oil Co.		
Kent—Salt layer (4 caverns)	470,000	Propane
Skelly Oil Co.		
Kent—Salt layer	160,000	Propane
Sun Oil Co.		
Wayne—Salt layer (2 caverns)	180,000	Propane
Wayne—Salt layer (2 caverns)	170,000	Butane
Wayne—Salt layer (under construction)	25,000	Butane
Mississippi		
Anchor Petroleum Co.		
Forrest—Salt dome	250,000	Propane
Forrest—Salt dome	250,000	LPG
Forrest—Salt dome	250,000	Butane
General Gas Corp.		
Forrest—Salt dome	35,700	Propane
Skelly Oil Co.		
Forrest—Salt dome	200,000	Propane
Forrest—Salt dome	65,000	Butane
Warren Petroleum Corp.		
Forrest—Salt dome	1,200,000	LPG
Montana		
Texas Natural Gasoline Corp.		
Wibaux—Salt layer	60,000	Propane
Nebraska		
Metropolitan Utilities District of Omaha		
Douglas—Mined shale and limestone (under construction)	150,000	Propane
New Jersey		
Esso Standard Oil Co.		
Union—Mined shale	300,000	Propane
Union—Mined shale	375,000	Butane
New Mexico		
Arrow Gas Co.		
Eddy—Salt layer (3 caverns)	71,000	LPG
Atlantic Refining Co.		
Lea—Salt layer	50,000	Butane
Lea—Salt layer	70,000	Propane
El Paso Natural Gas Co.		
Lea—Salt layer (2 caverns)	92,000	LPG
Lea—Salt layer (2 caverns planned)		Butane, propane
Skelly Oil Co.		
Lea—Salt layer	120,000	Propane
Lea—Salt layer	80,000	Butane
Warren Petroleum Corp.		
Lea—Salt layer	200,000	LPG
Lea—Salt layer	125,000	LPG
New York		
Anchor Petroleum Co.		
Steuben—Salt layer (3 caverns)	450,000	Propane
Steuben—Salt layer	120,000	Butane
Suburban Propane Gas Corp.		
Cortland—Salt layer	250,000	Propane
North Dakota		
Dakota Salt Chemical Co.		
Williams—Salt caverns (under construction)‡	150,000	Propane, butane
Ohio		
Standard Oil Co. (Ohio)		
Allen—Mined shale (2 caverns)	60,000	Propane
Texas Eastern Transmission Corp.		
Butler—Mined shale (4th and 5th caverns under construction)	835,000	Propane
Oklahoma		
Carter Oil Co.		
Pontotoc—Abd. oil wells	175,000	LPG
Shell Oil Co.		
Beckham—Salt layer	15,000	Propane
Sinclair Oil & Gas Co.		
Seminole—Mined shale	110,000	Propane
Texaco Inc.		
Beaver—Salt layer (under construction)	33,000	Propane

Underground Storage (Cont'd)

Company County and type of storage	Capacity (in bbl)	Product
Pennsylvania		
Sun Oil Co.		
Delaware—Mined granite	250,000	Butane
Delaware—Mined granite (under construction)	250,000	Propane
Delaware—Mined granite (under construction)	200,000	Butane
Rhode Island		
Suburban Propane Gas Corp.		
Newport—Mined cavern	200,000	Propane
Texas		
Anchor Petroleum Co.		
Martin—Salt layer (4 caverns)	300,000	Propane
Martin—Salt layer (2 caverns)	140,000	LPG
Bay Petroleum Co.		
Chambers—Salt dome (5 caverns)	1,570,000	Butane, propane
Cities Service Oil Co.		
Cochran—Salt layer	25,000	Propane
Cochran—Salt layer	10,000	Butane
Gray—Salt layer (2 caverns)	235,000	Propane
Gray—Salt layer	90,000	Butane
Midland—Salt layer	50,000	LPG
Continental Oil Co.		
Reagan—Salt layer	46,000	Propane
Cosden Petroleum Corp.		
Howard—Salt layer	50,000	Alky. feed
Howard—Salt layer§	30,000	Nat. gaso.
Howard—Salt layer	100,000	Propane
Howard—Salt layer	100,000	Butane
Dorchester Corp.		
Carson—Salt layer	80,000	Propane
Carson—Salt layer	35,000	Butane
Dow Chemical Co.		
Brazoria—Salt dome	500,000	LPG
El Paso Natural Gas Co.		
Ector—Salt layer (4 caverns)	60,000	LPG
Reagan—Salt layer (10 caverns)	820,000	LPG
Enterprise Petroleum Gas Co.		
Wood—Salt dome (2 caverns)	240,000	Butane
Gulf Oil Corp.		
Howard—Salt layer (2 caverns)	103,500	Raw product
Jefferson—Salt dome (2 caverns)	410,000	Ethylene
Jefferson—Salt dome	160,000	Propane
Jefferson—Salt dome	307,000	Butane
Jefferson—Salt dome	67,000	LPG
Humble Oil & Refining Co.		
Waller—Gas sand	500,000	Butane
Waller—Gas sand	1,000,000	Ethane, propane
La Gloria Oil & Gas Co.		
Jim Wells—Sand	75,000	Butane
Jim Wells—Sand	100,000	Propane
Lion Oil Co.		
Scurry—Salt layer (6 wells)	477,000	Propane
Scurry—Salt layer (2 wells)	136,000	Butane
Liquigas Co.		
Freestone—Salt dome	215,000	Propane
Freestone—Salt dome	112,000	B-P mix
Magnolia Petroleum Co.		
Liberty—Salt dome	2,100,000	Butane, propane
Liberty—Salt dome (2 projects planned)	.....	Ethylene
Midland—Salt layer	100,000	LPG
Pan American Petroleum Corp.		
Andrews—Salt layer (3 caverns)	166,100	Propane
Andrews—Salt layer	50,000	Butane
Ector—Salt layer (2 caverns)	151,300	Propane
Hockley—Salt layer (2 caverns)	180,200	Propane
Hockley—Salt layer	40,500	Butane
Hockley—Salt layer (planned)	.....	Butane
Pecos Co.		
Midland—Salt layer (4 caverns)	250,000	LPG
Phillips Petroleum Co.		
Brazoria—Salt dome (3 caverns)	1,544,000	Butane, propane
Ector—Salt layer	220,000	Propane
Hutchinson—Salt layer (12 caverns)	3,390,000	Butane, propane
Pure Oil Co.		
Andrews—Salt layer (3 caverns)	309,000	Propane
Jefferson—Salt dome	200,000	Butane
Reef Corp.		
Howard—Salt layer (4 caverns)	193,000	Propane
Howard—Salt layer (2 caverns)	82,000	Butane
Shamrock Oil & Gas Corp.		
Moore—Oil sand	1,190,000	B-P mix
Moore—Salt cavity	39,000	Propane
Shell Oil Co.		
Ector—Salt layer	365,000	Butane
Yoakum—Salt layer (2 caverns)	500,000	Propane
Sid Richardson Gasoline Co.		
Winkler—Salt layer (3 caverns)	369,000	Propane
Winkler—Salt layer (brine well)	70,000	.....
Skelly Oil Co.		
Carson—Salt layer	230,000	Propane
Carson—Salt layer	165,000	Butane
Southern Minerals Corp.		
Nueces—Oil sand	85,000	B-P mix
Standard Oil Co. of Texas		
Scurry—Salt layer (4 caverns)	127,500	Propane
Scurry—Salt layer	26,600	Butane
Sunray Mid-Continent Oil Co.		
Scurry—Salt layer (3 caverns)	97,500	Propane
Scurry—Salt layer	16,850	Butane
Texas Butadiene & Chemical Corp.		
Chambers—Salt dome (5 wells)	1,700,000	Butane
Texaco Inc.		
Hardin—Salt layer	600,000	Butane
Scurry—Salt layer	111,000	Propane
Texas Eastern Transmission Corp.		
Chambers—Salt dome (2 wells under construction)	1,000,000	Propane
Texas Natural Gasoline Corp.		
Chambers—Salt dome (3 caverns)	500,000	Butane
Glasscock—Salt layer	150,000	Butane
Harris—Salt dome (2 caverns)	650,000	Butane
Harris—Salt dome	500,000	Propane
Upton—Salt layer (4 caverns)	525,000	Propane
Upton—Salt layer (3 caverns)	375,000	Butane
Tuloma Gas Products Co.		
Fort Bend—Salt dome	312,000	Butane
Wanda Petroleum, Inc.		
Harris—Salt dome (2 caverns)	300,000	Butane
Warren Petroleum Corp.		
Chambers—Salt dome	3,600,000	Nat.-gas liquids
Crane—Salt layer (2 caverns)	164,000	Propane
Crane—Salt layer	120,000	LPG
Smith—Salt dome	950,000	LPG
Stephens—Mined shale	48,000	LPG
Wisconsin		
United Petroleum Gas Co.		
Pierce—Mined and sealed sandstone (construction project)	100,000	Propane
Total for U. S.	**49,024,690**	

Canadian LPG Storage Areas

Company County and type of storage	Capacity (in bbl)	Product
Alberta		
Alberta Underground Storage Co.		
Hughenden—Salt cavern (under construction)‡	143,000	Propane
Ontario		
Imperial Oil, Ltd.		
Sarnia—Salt layer	80,000	LPG
Sarnia—Salt layer	80,000	Butane
Sun Oil Co.		
Sarnia—Salt layer (3 caverns)	300,000	Butane
Saskatchewan		
Steelman Gas, Ltd.		
Melville—Salt layer (2 wells)‡	140,000	Propane
Total for Canada	**743,000**	

*Combination storage and miscible-phase displacement project. †Does not include aboveground storage. ‡Ultimate capacity of this comparatively new project described in accompanying story. §Not included in total.

Some of our readers might be startled by the conclusions the author reaches in this thorough and frank appraisal of drilling-rig drives. Basically, the author suggests:

Let's return to central power plants

. . . to simplify and cheapen machinery moving, rigup, and maintenance

BY W. S. CRAKE
N. V. de Bataafsche Petroleum Maatschappij
The Hague, Holland

ON DRILLING RIGS, transmitting and distributing power has steadily become more complicated. Here is a review of the problems found on available rig drives and on two newcomer electric drives: the d.c.-ring and the a.c. torque converter.

The review shows that many of the problems would be simpler if we returned to the "central plant" principle that we formerly had on steam drilling rigs. Other conclusions from the study are:

1. Only two complete solutions are visible for the transmission problem as a "plug-in" power plant, i.e., the a.c. torque converter and the d.c. ring.

2. The a.c. torque converter offers the best over-all possibilities and advantages, particularly simplicity.

3. Both systems should cost less than those currently produced, for equal power delivery.

4. A modern rig probably has a life of, say, 8 or more years before becoming ready for the scrap heap. At the rate of change in power requirements for this rig, the power plant is probably obsolete in 2-3 years; i.e., larger pumps are required which cannot be driven from an originally balanced transmission. It therefore becomes less and less competitive each year, as measured against newer rigs.

The cost of applying larger engines and overloading thereby, or rebuilding the transmission, is prohibitive. This is inherent in the normal power rig, and there is a serious question for the owner of whether to junk because of old age, rebuild into an unbalanced expensive-to-maintain unit, or continue use at less and less profit.

5. The a.c. system comes nearest to answering all seven requirements listed under **Obsolescence.** On this basis, and because of payout, it can increase the profitable "useful life" of transmission by 50%.

The d.c. ring is hurt in the "obsolescence analysis" by its interchangeability difficulties, even though it is estimated to be the lowest in first cost. In interchangeability among rigs of various sizes and makeup, the increase of useful life would be only half that of the a.c.

In this comparison its main shortcomings are (1) the fact that the main d.c. machines are of special design and are limited in interchangeable usage, and (2) the switchgear does not lend itself to expanding and contracting rigs in the fields with ease.

6. Although the a.c. system per full rig is estimated to cost slightly more than the d.c. ring, its simplicity and much higher interchangeability far more than compensate for the difference.

7. The a.c. rig will not require any more than normal electricians to maintain and repair. The electrical equipment is so simple that, on normal rigs, an electrician need not be on duty, except to check assembling and startup. If properly engineered, even this would be unnecessary, as the mechanic and crews could easily be trained to do most of this work.

8. The technical problem of paralleling generators and of motor starting can now be solved.

9. Only after there are more supply sources available for suitable equipment will final cost comparison be possible. In the meantime, successful application should result in reduced drilling, transport, maintenance, and moving costs.

A full-sized portion of an a.c. converter rig has been purchased in Holland for field proving: (1) the satisfactory solution of the electrical problems and (2) the suitability of the motor converter "power package" to drilling operations from the driller's viewpoint; i.e., handling characteristics.

It will be used at first on an existing draw works and pump.

Since the hoist and pump performance requirements are so different and will use the same "power unit," a separate unit is being tested on each service. If these field tests on the above machinery are successful, it could lead eventually to a full a.c. torque-converter rig.

Why this study? . . . Since World War II, average horsepower on drilling rigs has more than doubled. Main reason is the use of larger pumps which have proved very profitable not only in faster drilling but also, by combining with proper mud en-

Paper presented at the 1959 Petroleum-Mechanical Conference of ASME, Houston.

"Mechanical transmissions have grown alarmingly in size and cost"

gineering, to overcome many troubles such as caving, unnecessary circulation time, cleaning out, and stuck pipe.

Formerly, drag bits had to be used for soft-to-medium formations. Now, low-torque rock bits are almost universally used with the large pumps. These bits have resulted in fewer fishing jobs, particularly those involving such drill-pipe failures as twist-offs.

Along with the growth in size of the main rig machinery, there has been an even greater multiplication in amount and power of auxiliary equipment such as desanders, degassers, centrifuges, and much larger and more complex mud plants.

The end result is that in many cases drilling rigs have several sizes or makes of engines, and various sizes of auxiliary generating plants. Much of the purchased engine horsepower is idle on a "standby" basis.

Moreover, mechanical transmissions have grown alarmingly in size, complexity, and cost. There is possible little standardization or interchangeability among rigs, because of the differences between rigs purchased. As a result, the spare-parts-and-maintenance problem is extreme. These factors are very serious to large operators, especially abroad, where the operator is his own supply source.

When steam rigs were the most common type, all functions of the rig, i.e., hoist, rotary, pumps, and auxiliaries, were operated from a central power source, i.e., the boilers. There were no problems in transmission other than simple pipe connection to the boilers, even at greater loads, until the boilers became overloaded.

In most cases, drillers made a reasonable choice as to which unit to slow down on an overloaded boiler plant to get best results with the power available. If there was sufficient evidence that drilling was being seriously slowed, more boilers were added in simple parallel.

When the diesel engine was brought into the oil field, it introduced the "transmission," in place of piping systems. And, this portion of the rig has become more and more complex and expensive to buy, operate, and maintain as types and horsepowers of rigs have grown.

The transmission, either mechanical or d.c. Ward Leonard, is never as flexible as we'd like in its ability to place power where needed. Indeed, the highest compliment on a diesel rig to be heard from drilling crews is: She acts almost like steam." Every time something is added to the transmission to get nearer the characteristics we'd like, the complexity and cost go up.

What horsepower is needed? . . . There is very loose usage of the term "horsepower" as applied to drilling rigs. It should be remembered that, on the most efficient rigs, only 80% of this horsepower is delivered to the input shaft of the pump or draw works, and only about 60% to the hook.

Table 1 shows the commonly accepted efficiencies of various types of drive and various elements of the systems.

All investigations and figures in this paper are based on supplying the horsepowers named to the input of the function. The required engine horsepower, correspondingly, has the efficiency losses added.

In studying rig horsepower requirements, exclusive of auxiliaries, the problem is primarily nowadays one which the pump governs. This is illustrated by Table 3 which examines power requirements for several rig combinations.

Summing this up, it does not matter what class of rig is used; if the pump horsepower is the same, the rig horsepower is the same. Take, for example, a "light" rig drilling standard-size holes, say, to 5,000 ft. There may be enough increase in drilling rate to justify a large pump, i.e., 700-800 hp., if properly used, on development drilling, in normal soft to "medium hard" formations.

There is little difference in rotary-table horsepower in most drilling ranges in comparison with pump requirements, unless there are some abnormal conditions, such as directional drilling or very deep drilling under special conditions.

In any case drilling requirements, as opposed to hoisting, generally govern the rig-horsepower requirements. And the trend in this direction is still growing.

A light rig, if drilling full-sized oil wells, thus requires about the same pumps as a heavier rig. Or the size is close enough that most operators, for the sake of standardization, tend to adopt one or two sizes of pump as drilling standard. An exception to this might be the case of an extensive development program in a known field which would justify a special combination for most economical results. The pump size, with current trends, increases by about 10% in size per year. A standard probably would be in effect for 3 years before the size is raised for better results. In fact, about every 3 years, a new manufacturer's model makes a new standard necessary.

Problem of auxiliaries . . . The auxiliary horsepower problem has multiplied even more than that on the main rig—up to about 2.5 times prewar. Practically all auxiliaries are

TABLE 1—DRILLING RIG ASSUMED EFFICIENCIES
(Full Load)

1. Hydraulic coupling 96%
2. Each chain and shaft in a transmission 95% (at oil-field loadings)
3. Draw-works input to hook, 8 lines at 98%, drum 98%, 2 chains at 95% = 75%
4. Normal 4 eng. transmission to draw works; main drive 95%, 2 chains 95% = 85.5%
5. A.c. generator 92%
6. D.c. generator 92%
7. A.c. induction motor, const. speed 90%
8. D.c. fan-cooled motor 90%
9. Torque converter max. 82%
10. Combination a.c. gen. and a.c. motor (for auxiliaries) 80%
11. Combination a.c. gen. and a.c. motor torque converter, with chains to driven units 65% eff.
12. Combination d.c. gen. × d.c. motor × chain = 79% eff.
13. Combination mech. drive/fluid coupling × 3 chains = 81% eff.
14. Torque converter × mech. drive = 85.5 × 82 = 70% eff.
15. Over-all approx. efficiencies:
    (a) Mech. drive, to hook = 81 × 75 = 60.5% eff.
    (b) D.c. × d.c., to hook = 79 × 75 = 59.0% eff.
    (c) Mech. drive × torque converter, to hook = 70 × 75 = 52.5% eff.
    (d) A.c. × torque converter, to hook = 65 × 75 = 49.0% eff.

"Heavy rigs are now using over 200 hp. in auxiliaries, with mud mixing"

now a.c. driven, except mud-gunning pumps. And because of the difficulty in paralleling small generating plants, almost all rigs are purchased with 100% standby a.c. plant. Small plants now available have self-regulating, self-exciting features but these still depend on engine governing and individual generator excitation. And these must be controlled by detailed specifications, for satisfactory paralleling.

Heavy rigs are now often using over 200 hp. in auxiliaries, if mud mixing is included. Recent mud-control devices such as desanders or concentrators require up to 40 hp. each and they are most inconvenient to operate by individual engines because of their location, fire danger, etc. In some cases they are driven by a.c. motors and a separate a.c. plant is used to power them. This arrangement can hardly be justified as an original purchase but it will happen because of the availability of the power plants, and new motors or generators may be purchased for such uneconomical applications.

In any case, the rig problem, as a whole, is that auxiliaries use over 10% of total rig power (and, with standby, require 20% of the rig engines). Occasionally, for special purposes, they use considerably more, but none of the rig main power plant can assist in relieving this problem.

Table 2 examines auxiliary power requirements. The 106-hp. continuous load described does not include about 100 hp. extra, normally used for mud handling and mixing, or requirements on special-problem wells requiring heavier demands of power.

The transmission problem . . . In the heavier rigs, the transmission elements have become increasingly complex and inefficient. Standard "catalog" units are seldom purchased because they definitely do not fulfill the over-all rig needs adequately. The result is, generally, special transmissions which cost as much as $120,000 on a single rig (this is about 150% of the drawworks cost).

Some operators, because of problems of substructure, rigging up, tearing down, and moving, have purchased duplicate substructures for each rig. They regard this as part of the investment needed to keep a rig operating on a reasonably full-time basis. In some foreign operations, as many as 12 separate engines of various sizes have been installed at a rig—these were made necessary because it was impossible to apply idle installed horsepower to the point where needed.

The multiplicity of chains, bearings, and clutches in medium-to-heavy rigs means heavy maintenance expense.

The engine problem . . . Either the 1,200 or 1,800-r.p.m. engine is now

TABLE 2—AUXILIARY REQUIREMENTS DRILLING RIGS

Standard auxiliary equipment			Land operations	
Name of item	Number installed	Hp.	Usage	Remarks
Auxiliary generators	2	150 hp. (100 kw)	1 in service 1 spare	125 kva. Engine 150 hp.
Lighting	rig set	10		
Shale shakers	2x3 hp.	6		
Air compressor	1x15 hp. (or 2x15 hp.) (1 on, 1 spare)	15		One normally operated from rig transmission.
Water washdown pump	1x5 centrifugal 75 psi.	5		Also for hydromatic brake
BOP unit		5		BOP unit etc. driven from rig air supply.
Mud transfer pump (Mission)	1x15 (+ 1 spare)	25		
Mud stirrers (Lightnin')	2x15 or 4x5	30		
Mud mixers	2x5	10		
	Continuous load likely	106		Use 100-kw plant 80% load, normal reserve available.
Occasional Use	Desander	30-40	Some other service down when these used, or major units to bring in own motive power. One major unit possible to run from power plant.	
	Centrifuge	40		
	Deadline motor	10 (5)		
	Misc. small items, i.e. fuel pump, hand-tools, etc.	2		
	Stabbing board	3		
	Degasser	5		

Note: Marine rigs, plants larger to suit requirements. Electric rigs—additional power required for auxiliaries.

"It is difficult to standardize layout, especially in limited space"

almost standard throughout the drilling industry. A typical standard engine of 400 hp. for mechanical transmission is not adequate for torque-converter use and neither is the original transmission. Because of the overall efficiencies, on heavy-duty modern rigs (Table 1) the engine-transmission units are not large enough to power the heavier pumps as pump sizes have grown.

Consequently, it is common to buy independent pump engine transmissions. These multiply the number of main engines by at least 150%; the load factors drop, the investment per rig increases and the maintenance cost, facilities, etc., rise in proportion to the investment.

The term "standardization" applied to engines or other machinery must be a relative term. The "standard" engine of today will most certainly not be even the same engine even 3 years from now. And, as horsepower requirements increase, operators will need larger individual units within 3-4 years.

A given transmission does not allow the economical use of larger engines, nor is a transmission for more than four engines practical.

Because of these problems in matching ever larger engines, transmissions and pumps—the draw works having remained rather constant in requirements—it is not possible to have even reasonable long-term standardization. Nor, of more importance, it is possible for the operator to keep his rigs up to current full-power requirements economically.

The weight problem . . . The engine transmission-auxiliary power problem, with its many compromises of assembling, automatically increases the weight and number of transport loads for a rig in direct proportion to the weight. Often the load increase is in even greater proportion because of the peculiarly shaped assemblies resulting, some of which require that a tonnage capable of transport must be broken into two or more loads for moving.

Rigup, teardown problems . . . The problems of rigging up and tearing down are increased in time and cost to a greater proportion than the investment cost in equipment. They are wrapped up inextricably with the number of pieces of equipment involved, each one of which, in several ways, has to be connected to the drilling system.

The rotary-drive problem . . . With any conventional mechanical four-engine-drive system, either direct fluid coupling, or converter drive, the rotary table rarely needs one-fourth of the total hoist horsepower for its use. In order to have any proper control over drilling it is essential to split the rotary-table drive from the pump drives. This is conventionally done by allocation of one large engine to the table; this results in underloading this engine and often overloading of the rest.

Higher maintenance cost is the long-term consequence of this basic approach. And the problem is becoming progressively worse as engine sizes increase. There are means of bypassing part of the power of the engines, but this is a complicated and expensive compromise.

The location problem . . . With the fixed mechanical relationship of their parts, conventional rigs have problems in rigging up because of alignment and substructure level requirements. They do not permit placing rig parts where desired or where convenient for best usage, or for handling by transport. These problems often involve foundations, or wooden mats, or precision setting and unnecessary expense and space for assembly.

The mass of machinery and its frequent change in layout and content make it difficult to standardize layout, especially in limited space.

Obsolescence problem . . . As we've pointed out, the sizes of hoists, rotaries, and drilling tools, such as traveling equipment, have increased only slightly since the war. Pumps

TABLE 3—ENGINE SHAFT HP REQUIRED DRILLING RIGS

1,400-hp. heavy rig—Extra-heavy pump

Type of power transmission	Operation	Pump size x number pumps operating	Pump Hp.	Rotary hoist Hp.	Auxiliary Hp.	Mud system Hp.	Total Hp.	Rig-engine Hp.
A.c. torque conv.	(a) Drill	1,000x1	(1,000)	(200)	(150)	(100)	(1,450)	
system. inf.			1,500	308	188	125	2,161	
speed change	(b) Hoist			(1,250)	(100)	(100)	(1,450)	
				1,925	125	125	2,175	2,175
Mech. drive	(c) Drill	1,000x1	(1,000)	(200)	(150)	(100)	(1,450)	
simple step			1,235	247	188	125	1,795	
transmission	(d) Hoist			(1,400)	(100)	(100)	(1,600)	
				1,730	125	125	1,980	1,980
D.c. drive almost	(e) Drill	1,000x1	(1,000)	(200)	(150)	(100)	(1,450)	
inf. speed			1,270	253	188	125	1,836	1,836
				(1,250)	(100)	(100)	(1,450)	
	(f) Hoist			1,580	125	125	1,830	
Mech. torque	(g) Drill	1,000x1	(1,000)	(200)	(150)	(100)	(1,450)	
conv. inf.			1,430	286	188	125	2,029	
speed	(h) Hoist			(1,250)	(100)	(100)	(1,450)	
				1,790	125	125	2,040	2,040

Note: Figures in parentheses = function horsepower; open figures are engine horsepower needed to give function horsepower.

have been the main reason for higher horsepower.

There are many mechanical problems in locking pumps together in parallel or series. Moreover, higher drilling pressures make older pumps unsuitable in multiple. For these reasons there has been an increase every few years in the sizes, or numbers, of engines and transmissions per rig. This increase plays havoc with investments and simplicity.

How do we keep perfectly good engines and transmission elements on the job and out of idle storage? How do we prevent them from being prematurely junked by overloading? These are ever-growing headaches to operators.

There is a useful life for a mechanical transmission at the current trend, beyond which its use raises drilling costs so high that the rig is no longer competitive. This useful life is likely not more than 4 years. On the other hand, its built-in original life, loaded as designed, is probably 8-10 years.

This is an untenable position, since, taxwise, the machinery cannot be written off at the end of its true useful life. i.e., 3 or 4 years. The industry cannot allow such a situation to continue.

What must be found, if possible, is a "transmission," from engine to rig function, which:

1. Prolongs engine life and raises load factor.
2. Raises permissible engine ratings if possible by better usage for occasional demands.
3. Prolongs transmission useful life.
4. Simplifies the equipment to the maximum.
5. Provides easy interchangeability between rigs for different drilling depths.
6. Reduces the use of machine shops and heavy repair facilities.
7. Is more portable and flexible in usage.

If we can find a method which suits these needs, we can change the entire obsolescence picture:

...If the transmission increases the "useful life," say 50%, the operator can afford to pay more for it originally, and still be ahead.

...If it increases interchangeability, it provides for reduction either of inventory or capital cost.

...If it requires less maintenance or spare parts per unit, this is profit.

...If it is more easily moved and rigged up, this reduces drilling costs.

...If it permits simple expansion or contraction of rigs to "keep up with the Joneses," this reduces drilling costs.

Today's Power Plants Cost

These are the power plants now available: mechanical; mechanical-torque converter; d.c.-Ward Leonard; d.c. ring; a.c.-torque converter; and hydraulic. Other approaches will take their proper places in the picture as they become proven and economical. The diesel or gas engine is the most economical, proven, prime mover now available.

Power demands of four rig types are included under Table 3 and illustrate the difference in horsepower required for three typical classes of rigs. Some comparative cost estimates (1958 Europe) of five types of heavy rig transmissions are summarized in Table 4.

Mechanical drive . . . Let us consider the drive which is all-mechanical except for a fluid coupling between engine and transmission. Estimates of transmission costs include only a simple two-pump drive, and any mechanisms to drive a third pump for any purpose must be added. The cost of a 100-hp. independent pump for mud mixing is included. All auxiliaries are separately a.c. driven.

Mechanical-torque converter . . . Our next rig is similar to the first but has a torque converter on each engine in place of the hydraulic coupling. Heavier transmissions are needed for this service, or much higher maintenance costs can be expected. All auxiliaries are separately a.c. driven.

D.c.-Ward Leonard . . . Let us look at the d.c.-Ward Leonard drive. We will consider any of the many variations of conventional d.c. drives, and one on which it is necessary to allocate each load to definite generators. Varying generator voltage controls speed of the driven load.

The simplest form of this type is one in which four engine-generator sets are used. To can fully power the pump. One is allocated to the hoist-rotary table and one either is free, or can add its power to the second pump in parallel for more pump output, if needed. For hoisting, at least three engines are applied to the hoist, while the fourth may be used for auxiliary use of the pump.

In its most economical form, identi-

TABLE 4—SUMMARY OF RIG POWER-PLANT COSTS*

1,300-hp. size rig (heavy)

	Pump	Hoist	Auxiliaries
Load when drilling (net horsepower at function shaft)	1000	200	250
Load when hoisting (net horsepower at function shaft)	...	1,250 (1,450 mech.)	200

Type rig drive—	Purch. hp.*	Per cent efficiency	No. of engines	No. of sizes eng.	Estimated wt. tons power plant†	No. of loads	Est. cost U. S. ($)	Per cent drilling capacity one engine down
Mechanical	‡2,529	81	7	2	102	10	344,000	100
Mechanical-torque	‡2,525	70	7	2	102	10	357,000	95
D.c. Ward Leonard	‡2,925	79	7	2	100	8	350,000	100
	§3,325	79	7	2	93	8	325,000	...
D.c. ring	†2,325	79	4	1	92	8	332,000	90
	§2,800	79	4	1	85	7	307,000	100
A.c. torque converter	†2,400	65	4	1	90	6	341,000	95
	§2,800	65	4	...	80	6	316,000	100

*Net tropical continuous rating. First two require purchasing 600 hp. engines—500 hp. sufficient, but not available. †Excluding drilling machinery, but including driving units, auxiliary engines, transmissions. ‡Using heavy-duty 1,200-r.p.m. drilling engines. §Using lightweight 1,200-r.p.m. engines—suitable for constant-speed drives, generators.

cal motors drive pump or hoist. For hoisting, motor rating is almost twice the full load for pumping duty. For simplicity's sake, the rotary is driven from the main hoist motor. A separately driven rotary table adds much to cost and to complexity of switch gear.

D.c. motors are extremely reliable. So, it is not necessary to use twin motor drives either on pump or hoist unless this cuts over-all costs.

All auxiliaries are separately a.c. driven.

D.c.-ring drive . . . A new rig-drive system is in operation in Holland for the first time. This d.c.-ring drive is a constant-current system which allows the engine power to be taken from whichever motor is desired, up to maximum motor rating, from the "ring" or "loop" bus bar. Thus engines or generator sizes are not necessarily related to the size of the individual functional requirements, and all engines are normally equally loaded, regardless of which load is taking the power.

Auxiliaries may be driven from the constant-current ring by a d.c.-a.c. motor converted to give the a.c. required for the auxiliaries. Only a small, i.e., 10-kw., emergency lighting-starting engine is needed to supplement the main power plant.

Thus, for the first time, d.c. with its desirable torque-speed characteristics, is available as a whole power plant capable of applying all power equally where needed on a rig, from the main engines.

How d.c. ring works . . . All the generator and motor armatures in the system are connected in series. Constant current is produced by the generator by precision (amplydyne type) exciters and thus at full field power the system voltage becomes the sum of the individual generator voltages. At zero power output the voltage is only that required to overcome the sum of all connected armature resistances. Zero excitation in the motors means zero speed.

As motor excitation on any one of the motors is raised, speed increases and back e.m.f. generated by the motors is countered by the generator exciters which raise generator voltage to maintain the constant current in the armatures.

The commutators on motors and generators of this system are naturally larger than normal. This is because

Table 5–Advantages and Disadvantages

Type—	Advantages	Disadvantages
(a) Mechanical	1. Simple assemblies of parts. 2. Simple controls. 3. High efficiency—80%.	1. Multiplication of parts. 2. Alignment problems. 3. High maintenance costs. 4. Rigidity of layout. 5. Poor control of power flow. 6. Requires heavy-duty variable-speed engines. 7. Multilevel, expensive, heavy substructures (duplicated each rig). 8. Little interchangeability of parts between rigs of different sizes. 9. High installation costs, tear-down costs. 10. High transport costs, weight. 11. Open machinery exposed during moves. 12. Auxiliary separate plants. 13. Step type transmission performance.
(b) Mechanical-torque converter	1. Simple assemblies of parts. 2. Smooth curve of hoist power input, pump input. 3. Better mean horsepower output from driven machines—usually enough to use same engine sizes as (a). 4. Can use less heavy-duty engines since, if converters properly applied, maximum engine load positively limited (if governors accurately set).	1. High cost. (Same as 2-12 mechanical rig) plus 14. Increases maintenance on transmissions or, alternatively, heavier transmissions. 15. Low efficiency—70%.
(c) D.c. Ward Leonard	1. Permits rig to be laid out as desired since parts connected by cables. 2. Highly desirable driving characteristics. 3. Reasonable interchange parts between rigs of different ratings i.e., motors, generators, engines. 4. Can use lighter-duty constant-speed engines. Engine loadings can be electrically limited. Low engine maintenance. 5. Weight less than mechanical. 6. Transport loads less than mechanical. 7. High efficiency—79%. 8. Low maintenance costs.	1. High cost. 2. Necessity matching engine sizes to function sizes and waste of installed engine horsepower. 3. Cost and complexity and weight of switchgear. 4. Limited interchangeability for different assemblies due to switchgear. 5. Limited interchangeability of different sizes generators and motors between rigs, due to switchgear. 6. D.c. complex control systems not suitable for isolated places due to electrical problems not commonly encountered by electricians. 7. Auxiliary plants separate.

of the constant full load current being absorbed by each generator and motor, while the individual generator voltages are low.

Mainly for reasons of economy, motors of less than 1:4 horsepower range, i.e., 250 to 1,000 constant horsepower are considered impractical. The smaller motor armature has to absorb full current and the cost of such motors (mainly the armatures) is excessive.

This range of motor sizes adequately covers main loads on drilling rigs. The auxiliaries may be driven by the same size motor (250 hp.) required by the rotary table. This involves assembling a d.c. motor-converter set to give a.c. at constant frequency.

All generators and engines split the load evenly and each motor could absorb up to 1.8 times its continuous horsepower rating on "intermittent" service. Of course, the sum total of motor horsepower demand cannot exceed the sum total of engine horsepower available.

There is a problem when motors are idle, i.e., with constant current through the armature but stopped still for more than 5 minutes. The commutator segments and risers overheat due to the continuous flow of current through a limited number of them. Thus, for oil-field use, the motors have an automatic short-circuiting switch built onto the motor. This switch may be closed automatically to shunt the current past the motor at the stop position. Or it may have a time delay relay which closes the switch within the time limit in case of a motor stalled against load.

Since the short-circuited voltage across the motor armature is no more than 2 to 3 volts, the switch is very compact. Since the circuit is opened or closed before the parallel circuit, the switch gap for a 2 to 3-volt circuit is very small.

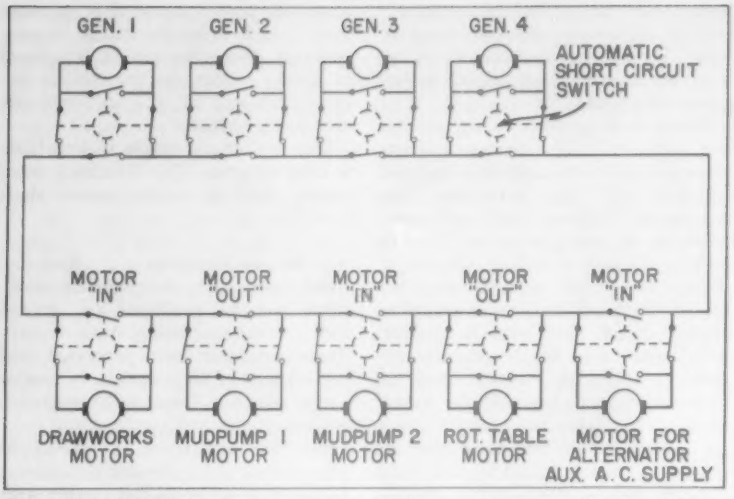
Fig. 1 shows a simple typical basic writing diagram. The efficiency from engine shaft to motor output shaft is 80%.

A.c. torque converter . . . Recently, there have been developed suitable-sized, standard-produced a.c. generators with self-regulating, static exciters. These machines have permitted electric motors of large size to be started across the line from such generators with negligible voltage drop and duration (20% and about ½ second). A plant about 50% loaded can have a motor 70% of plant size started with-

of Various Types of Rig Power Plants

Type—	Advantages	Disadvantages
D.c. ring constant current	1. Low cost. 2. Power distributed equally, all engines. 3. Less packages than mechanical. 4. Less weight than mechanical. 5. Simpler switchgear than d.c. Ward Leonard. 6. Simpler cabling, less cables. 7. Auxiliaries can be driven by main engines. 8. More maximum rating can be taken from engines in emergency due to "bus bar" system. 9. Torque characteristics excellent. 10. Rigup when desired. 11. High efficiency—79%.	1. D.c. generators and motors "special" types. 2. Controls rather complex. 3. D.c. difficult to maintain in remote small areas—electrical problems. 4. Motor sizes limited to max. 4:1 output (commutators score capacity amps. all sizes). 5. "Ring" not expansible and contractable easily—control problems, voltage problems.
A.c. torque converter variable-blade converter	1. Low cost. 2. Highest interchangeability generators—power units. 3. Bus-bar system—power where needed. 4. Simple electrical equipment and controls. 5. Simple torque converters. 6. Engines different speeds can be interconnected. 7. Auxiliaries included, main plant. 8. Rigup where desired, due to even power distribution, all engines. Higher peak rating from given engines. 9. Low maintenance cost equipment. 10. Fewest loads, weight. 11. Easiest rigup, teardown. 12. Smooth power curve hoists ideal torque characteristics.	1. Low efficiency—65%. 2. Rotary drive from large unit inefficient. May require special hydraulic drive.

Note: On all rig types with functional power distribution, engine loads must be set, for reasonable maintenance, to deliver "maximum continuous rating." This is because functions will generally fully load individual engines, since engine sizes are selected to this end. On bus-bar systems, since each engine takes equal share of load and full load rarely occurs, engines can be set to give intermittent ratings in case one engine "down" or excessive auxiliary horsepower is occasionally needed. This, in effect, raises the true efficiency of the a.c. plant by permitting higher mean load factors of purchased engine horsepower to be usefully employed without overload.



CONSTANT-CURRENT-LOOP drilling rig holds promise as a highly efficient, versatile drilling unit. Efficiency from engine shaft to motor output shaft is 80%. Fig. 1.

out serious disturbance to the remaining connected equipment.

Conventional regulators with moving, wearing-out parts have been too trouble making even to consider for use on drilling rigs. So, this recent development has for the first time opened the door to use of a.c. as simple trouble-free motive power for rigs without excessive generating capacity. Simultaneously, since the war, adjustable-blade torque converters have been developed in suitable sizes, now up to 2,000 hp. These permit the use of the a.c. squirrel-cage, high-speed, lightweight motor as the driving element.

The squirrel-cage motor is probably the most reliable piece of equipment made. The torque converter is reliable to an almost equal degree if properly applied. The combination of the two gives for the first time a power unit of low weight, and adequate power to be driven by the a.c. plant. Speed is controlled entirely by opening and closing the converter blading. Its reliability is such that a single unit is likely satisfactory for rig drive.

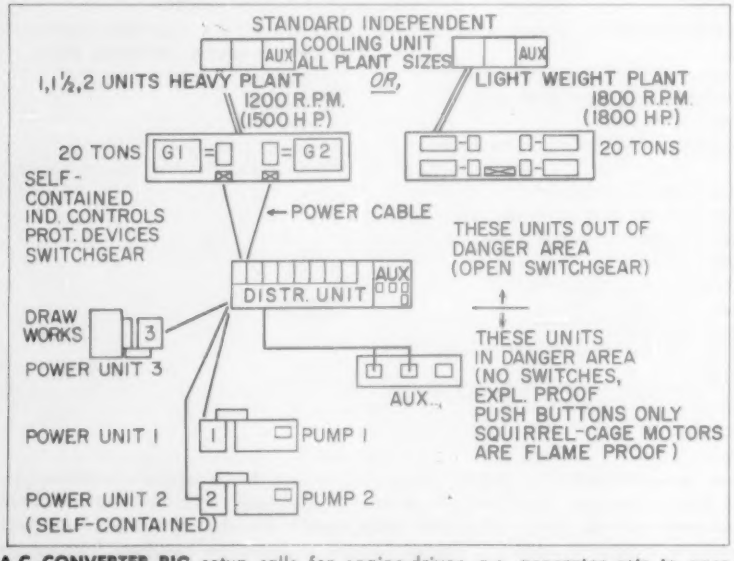
All rig auxiliaries are also driven from the a.c. bus-bar system. All engines divide the power equally, and all can yield equal overload capacity when required. Only one size of engine, other than, say, 10-kw. starting of "dry watch" unit, is needed for a rig.

On the a.c. torque converter rig, engine-driven a.c. generator sets would operate in parallel. They would use large-sized 400 to 1,000-kw. equipment with no moving parts and they are probably the only type which should even be considered for drilling use.

Power from the bus bars of the plant would be fed to all rig functions on demand, thus splitting all the load between engines equally.

Power will be taken from the plant to draw works, pumps, auxiliaries, rotary by a.c. 1,760-r.p.m. motors direct-coupled to 1,760-r.p.m. adjustable-blade torque converters. Speed control by the converter makes step-down gear unnecessary. The output shaft runs at a full-load speed suitable for ordinary oil-field machinery. Converters are available in several sizes up to 2,000 hp. to suit oil-field loads. The over-all engine-shaft to converter-output shaft efficiency is 65% (compared with 80% for mechanical and 70% for mechanical-torque converter).

Fig. 2 shows the general concept of this type rig.



A.C.-CONVERTER RIG setup calls for engine-driven a.c. generator sets to operate in parallel. Power from the bus bars would be fed to all rig functions on demand, thus loading all engines equally. Fig. 2.

Hydraulic unsuitable . . . The positive-displacement, full-hydraulic drive is available for small rigs. It is not, however, generally available in the 500-700-hp. hydraulic pump and motor sizes required. It, therefore, cannot be given further consideration.

The hydraulic rig is similar to the d.c. Ward Leonard in that engines or pumps have to be allocated to loads since each load requires a different speed (fluid volume) or torque (pressure).

The hydraulic system is unattractive because of the problems in switching or manifolding and controls, pipeline connections, exclusion of dirt, and assembly. Controls and piping will also be complex, awkward, and expensive.

Certain pieces of hydraulic equipment, however, are attractive with other assemblies, i.e., d.c., a.c., or even mechanical assemblies. Hydraulic drives may be used for such purposes as rotary drives, coring-reel drive, etc., so long as the system is closed, involving no opening up of hydraulic piping for transport.

Speeds affect transmission . . . On any given mechanical transmission, engines of all one speed are a must. On mechanical-torque converter systems they are practically a must because of the differences in torque-converter output characteristics.

Most drilling engines nowadays are 1,200 to 1,800 r.p.m. Both of these speeds can be used on the same rig electrically, if engine-governor char-

acteristics and alternators are reasonably equal.

On a.c. sets this is common power-plant practice. It can be done with d.c. if the generators are designed for identical output characteristics.

For the purpose of this article, electrical equipment should be thought of as a part of a transmission and not as a power plant in the ordinary sense. Drilling demands light weight, and 1,200 and 1,800 r.p.m. proven engines are available at these 60-cycle speeds.

The large adjustable-blade torque converters available have their highest output capacities at 1,760 r.p.m. input speed, and this determines the frequency and particularly the vital weight and dimensions of the power-using unit.

Converters of higher than 1,760-r.p.m. input may be developed in the future. If so, there is no reason not to consider frequencies to match, if prime movers, i.e., turbines, are available for higher speeds. It would be necessary in this case to see that the problem of auxiliaries does not become too expensive. Since, however, 60-cycle auxiliaries are so widely used and since 60-cycle motors are available off the shelf, 60 cycles is considered to be the best standard for the a.c. rig at this time, regardless of the frequency of the local utility plant.

Long-Range Planning

There is a strong need for both operators and suppliers to make logical long-range plans for drilling machinery with respect to: (1) simplification, (2) portability and flexibility, (3) mobility, (4) interchangeability of usage over a broad range of drilling conditions, (5) usage of equipment tending to reduce obsolescence by ability of main power elements to fit into expanding rate of rig horsepower increase, and (6) low maintenance costs.

The rig size required to drill a given well is directly tied into the hole sizes drilled. New technology of drilling may either increase the present rate of rig growth, or reduce it. The power machinery should be equally usable in either case, by simple additions or subtractions in the field.

The transmission is the heart of the rig's trouble. Until this problem is solved on a rational basis, no major changes are proposed or necessary, in the main power-using devices such as hoist, rotary, pumps, and auxiliaries.

From the study of the "Advantages and Disadvantages" (Table 5) of the six types of transmissions available, the direct mechanical, mechanical-torque converter types have nothing to recommend their continuance in multiengined or high-horsepower rigs. Slightly more desirable than these mechanical drives is the d.c. Ward Leonard, which is still wasteful of engine power because of functional control requirements. The d.c. Ward Leonard does have much better portability, and flexibility of layout.

Only the d.c. ring and the a.c. torque converter drives provide the "central-power-plant principle" equity in engine loads and combine the auxiliaries into the network. Because of the wide range of auxiliary services and their increasing size, this feature is highly important.

From a technical basis, safety, simplicity of parts, and usage standpoint, the a.c. version stands out above the rest.

At last there is a solution to the problem of minimizing the number of sizes of generating plants and of using these in parallel with yesterday's going-out standard until worn out. Generators have extremely long life and will undoubtedly outlive two or more engines of current standard variety. Generators require virtually no spare parts, and negligible repair, if reasonably maintained, and if purchased with modern insulations and controls.

Mobility . . . About 650 hp. is the limit for economical trailer mounting. Reasons are limitation of width, weight on trailers or skids, and centers of gravity. The stumbling block is engines and transmissions.

A 1,000-hp. rig might be used on trailers if electric drive were used and the hoist were rotated on its trailer at 90° to normal.

The switch to electric drive, therefore, opens up a whole new field of mobility which can be exploited by the ingenuity of the industry for lower moving-rigup costs.

Is equipment available? . . . Both the d.c. ring and the a.c. torque converter rig are new in the heavy-rig field. The first of the d.c. ring drives is now in operation in Holland on a full-scale rig, less auxiliaries. An 800-hp. hoist is equipped with two 400-hp. motors on the hoist, one 800-hp. pump with two 400-hp. motors, and one 400-hp. motor on a smaller pump. Power is supplied by four 400-hp. engine-generator sets (one a reserve unit in this case).

This plant is designed so that a second 400-hp. motor on the No. 2 pump and a fifth generator may be added to fully power a 1,100-hp. rig with 800-hp. pump, including all auxiliaries, should the rig perform as expected.

A.c. converter rigs have been in successful use in Germany for 1 or 2 years, but none are yet equipped with the largest converters.

A partial a.c. converter rig is on order in Holland, later to be expanded into a full rig of the 1,400-hp. class, if successful.

From the supply viewpoint, both a.c. and d.c. equipment is currently less expensive in Europe than in the U. S. Furthermore, some of the equipment is not generally available in the U. S. This includes heavy torque converters, d.c. ring-type motors, generators, or controls, a.c. self-regulating generators in 400-500-kw. sizes, without which the a.c. system cannot be economically used.

Both the d.c. ring and a.c. converter rigs would about equal the cost of present simple standard oilfield equipment such as is currently manufactured.

To prove the electrical equipment for drilling service, it must be field tested. Starting loads must in no case cause voltage drops sufficient to drop out auxiliaries or interfere with engine operation. This whole subject has been carefully investigated in Holland and, thus far, no difficult problems are expected. The test unit will demonstrate this ability.

Engine problems . . . The a.c. or d.c. ring rig, due to its even engine loading, allows higher engine loadings for intermittent usage than is permissible on a functionally controlled rig.

For the a.c. rig, however, the engine governor must be of the hydraulic type. All engines—although sizes or speeds need not be the same, i.e., 1,800 r.p.m.—can run in parallel with 1,200 r.p.m., but should have the same governor drop characteristics. This is economical standard equipment.

The generator unit must have enough kinetic energy to stand the shock load of heavy motor starting. If necessary, heavy motor starting might have to be made automatically impossible unless the plant is unloaded to the desired degree. Only a full-scale field trial can fully define the necessities. The whole system will be kept as simple as possible and complications added to the minimum needed.

It should be noted that any of the proposed constant-speed solutions would permit the use of any other suitable and economical prime mover. This includes gas turbines or free-piston turbine units whenever they are considered sufficiently reliable and economical. These types are definitely more suited to constant-speed than variable-speed operation.

How Humble rates its gas turbine

"Although operation has been satisfactory, axial-compressor and axial-compressor-turbine efficiencies have been below par. A plan has been worked out . . . for work to be done during the next down time that should result in improved efficiency."

BY CHARLES BULTZO
Senior Mechanical Engineer,
Technical Division,
Humble Oil & Refining Co.

THE 5,000-HP. gas turbine in use at Humble Oil & Refining Co.'s Baytown refinery has proven highly satisfactory. The equipment is a simple-cycle, two-shaft gas turbine. It drives a high-capacity centrifugal blower supplying regenerator air to a fluid catalytic cracking unit.

For maximum over-all thermal efficiency, the hot exhaust gases are combined with the regenerator air after it leaves the process unit. These gases are then used to generate 600-psig. steam by burning the CO in the combined stream. A heat balance has been devised to provide a method whereby field personnel can determine the performance of a gas turbine.

Although operation has been satisfactory, axial-compressor and axial-compressor-turbine efficiencies have been below par. A plan has been worked out with the manufacturer for work to be done during the next down time. This should result in improved efficiency and operation.

Paper presented at ASME Petroleum-Mechanical Conference, Houston, September 21-23, 1959.

Lube-Oil Piping

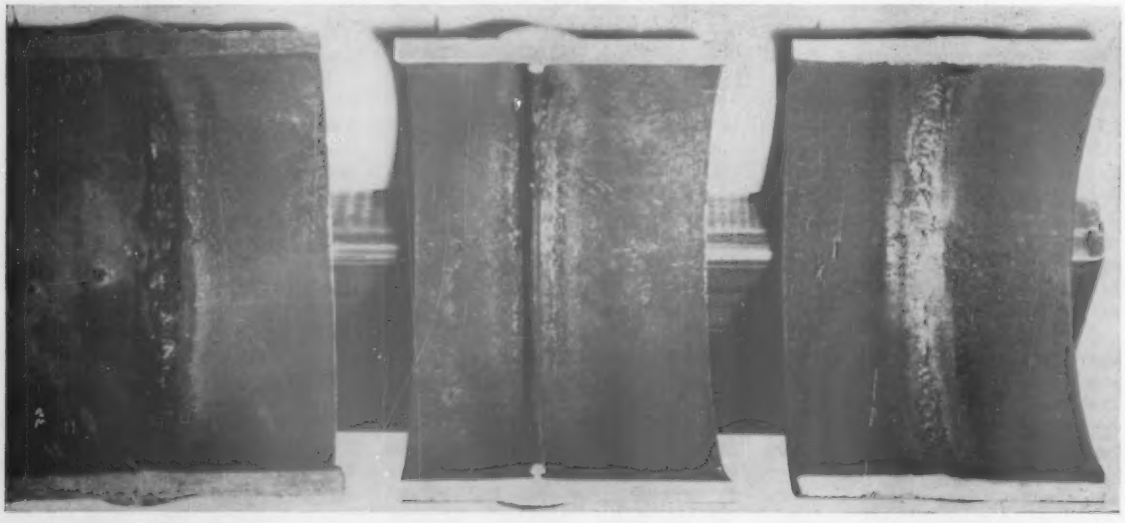
A problem common to all new-machinery installation is that of getting a clean lube system. In one gas-turbine installation, 6 weeks were spent in cleaning. This included circulation of hot oil, acid-cleaning a portion of the system, and additional circulation. This time could have been reduced by:

1. Acid-cleaning the pipe just before erection. In this case, the piping had been fabricated, acid-cleaned, and shipped about 8 months before erection. Though given normal protection, the inside diameter of the pipe was well coated with rust at erection time.

2. Proper location of the filter. In this case, the full-flow filter was located about 60 ft. from the bearing distribution header. Had the filter been located at the header, downstream piping of stainless steel would have been warranted, eliminating the original cleaning problem. This would also preclude rust formation during an extended future down time.

3. Welding procedure. The piping had been fabricated using the conventional manual weld process with the resultant deposition of slag at the root of the weld. Since slag is inert, and not affected by the pickling process, it was necessary to hammer the welded seam during circulation. Fig. 1 shows sample welds where conventional manual welds, conventional manual welds with backup ring, and inert-gas shielded tungsten electrode processes were used. Given the same acid-cleaning time (Fig. 2), only the heli-arc sample shows a clean weld.

Filter trouble . . . Even with the care given the lube system on this machine, one incident confirmed the need for improvement. The governor oil is taken upstream of the full-flow filter and passed through a scraped-surface-type filter capable of 50-μ filtration. With no warning, the turbine



Conventional manual weld. Conventional manual weld with backup ring. Inert gas shielded tungsten electrode weld.

CONVENTIONAL WELDS show a heavy slag deposit, Fig. 1.

began to slow down until it had reached the minimum governor setting.

After 3 or 4 hours at this speed, the difficulty was traced to this filter. A few turns of the filter element and the turbine returned to operating speed. In operation, the filter had slowly plugged until little or no pressure was being delivered to the governor.

Instrumentation

Most gas turbines are well protected by instrumentation. This usually involves overriding and backup instruments. In the case of high exhaust temperature, three instruments are involved, as shown in Table 1.

When a shutdown occurs due to high exhaust temperatures, at least the pneumatic and vapor-tube thermostats must be checked before the turbine can be returned to service. Errors in the range of 20°-30° F. have been found in these instruments. For this reason, an operator could start unloading a turbine due to a high indicated exhaust temperature that does not actually exist.

Due to construction, the instrument indicating combustor outlet temperature could not be serviced in operation. It was necessary to install a bypass circuit to permit servicing. Even with this, one shutdwon occurred during a chart change. Additional flexibility for servicing should be provided.

The effect of a turbine shutdown on a fluid catalytic cracking unit usually involves loss of throughput (reduced capacity), an upset unit which usually takes several hours to line out, and in some cases loss of a boiler. Simplification of the instrumentation appears to be in order to give more latitude to the operation. This would involve more expensive instruments, but the additional cost can be justified.

Operational Fouling

A recurring problem to gas-turbine users is that of the high fouling rate of the axial compressor and the resulting loss in compressor efficiency. With a given load, fuel consumption and combustor outlet and exhaust temperatures increase as fouling increases. This fouling is the result of insects, steam or hydrocarbon vapors, or solids in the form of dust in the atmosphere.

After some 1,200 hours of operation, a cursory inspection of the axial compressor revealed a buildup of approximately 1/32 in. on the leading edge of the stationary blades. However, the manufacturer advised that this degree of buildup was not unusual and should not adversely affect the operation of the unit.

Although several performance tests had been attempted on this turbine, on each occasion the data could not be used because the instruments were not properly calibrated. These included flowmeters, fuel meters, and exhaust-temperature indicators.

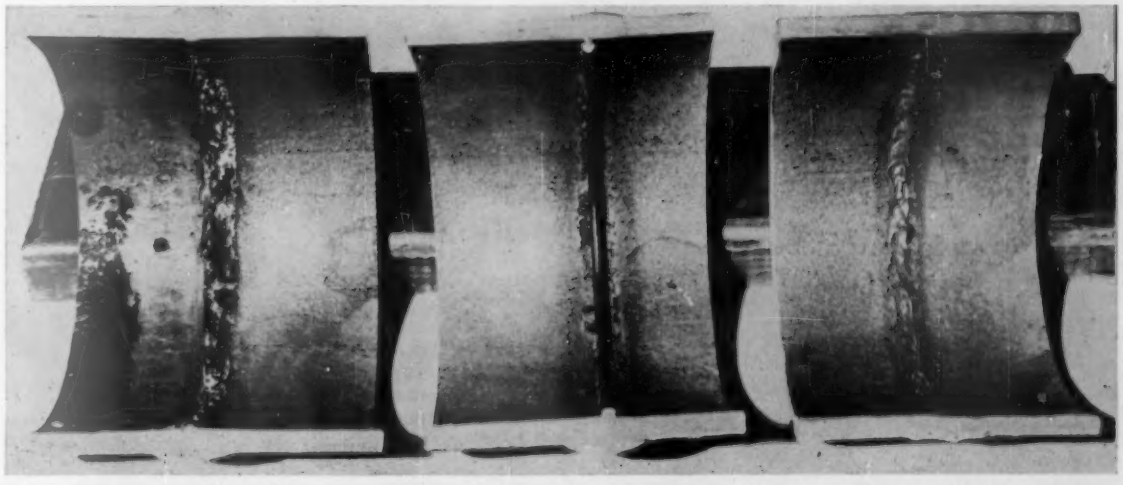
After 1,900 hours of operation, the first of several acceptable tests was completed. It was found that the maximum output of the gas turbine was limited to 3,300 hp. This limitation was imposed by high turbine inlet and exhaust temperatures. It was also found during these tests that the maximum blower speed that could be developed was 5,200 r.p.m. which is 90.5% of the maximum continuous speed.

Cleaning . . . The operating instructions supplied with this turbine contain a procedure for solvent cleaning the axial compressor. However, we felt that each cleaning by this procedure would cause a shutdown of at least 24 hours, resulting in a high process debit. Reports of cleaning of single-shaft gas-turbine axial compressors with very fine spent catalyst were reviewed to see if this procedure could be applied to the two-shaft machines.

Drawings of the two-shaft gas turbine indicated a need to supply clean air (catalyst free) to the two sets of internal bearings. Purge air had to be supplied to the axial compressor dis-

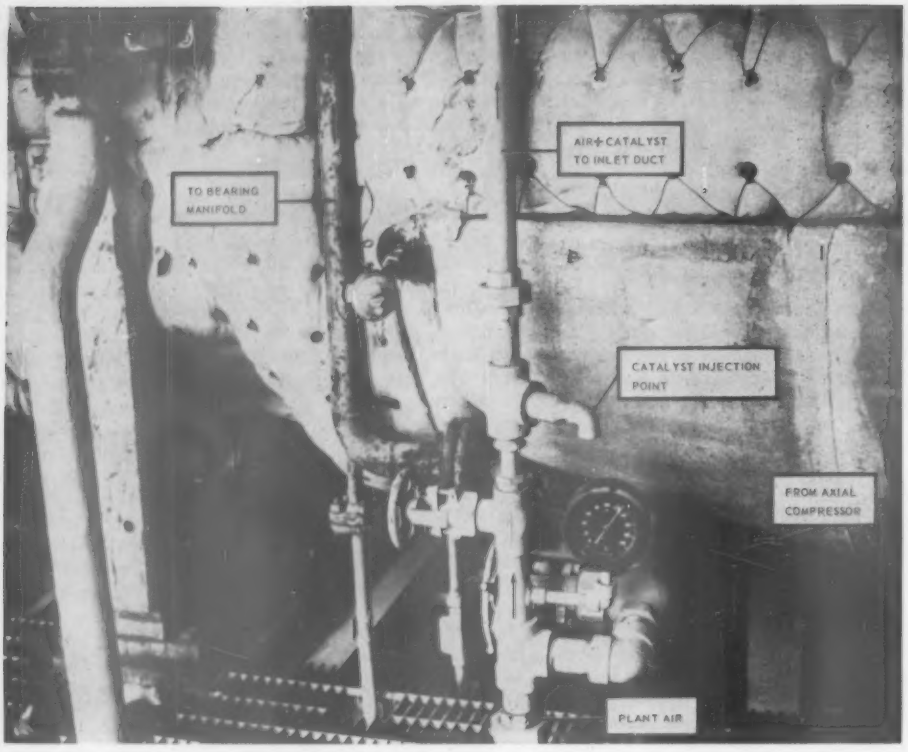
TABLE 1——INSTRUMENTS TO PROTECT GAS TURBINES

Instrument	Function
Alarm (tied to temperature recorder)	1. Sounds alarm 25° before maximum exhaust temperature is reached.
Pneumatic thermostat (shows decrease in signal pressure due to temperature rise)	1. Starts slowing down turbine 25° before maximum exhaust temperature is reached. 2. Shuts down turbine at maximum exhaust temperature.
Vapor-tube thermostat (indicates temperature directly)	1. Shuts down turbine at maximum exhaust temperature.



Conventional manual weld. Conventional manual weld with backup ring. Inert gas shielded tungsten electrode weld.

ONLY THE HELI-ARC SAMPLES show a clean weld after acid treating. Fig. 2.



AXIAL COMPRESSOR supplies air to bearing seal manifold. Fig. 3.

charge pressure switch to prevent fouling. The manufacturer advised that 750 c.f.m. at 28 psig. would be required.

The bearing seal air is provided through an external line from the axial compressor to the bearing seal manifold. A connection was made from the plant air system to the external line (Fig. 3). The valve in the plant air makeup line was then slowly opened until both the upstream and downstream portions of the line were cooled, thus insuring that a more-than-adequate supply of air was being delivered to the bearing seals.

Method of Cleaning

Catalyst injection was made through an aspirator which injected the catalyst in the inlet ductwork above the silencer. This insured complete mixing and thus uniform cleaning. The injection was made during two separate runs in an attempt to determine the optimum injection rate.

During the first run, approximately 25 lb. of spent catalyst were injected over an 8-minute period at about 3 lb. per minute. During the second run, approximately 10 more pounds were injected at the same rate. Results of the cleaning operation are shown in Table 2.

The only practical way to reduce fouling of the axial compressor blades appears to be in the installation of an inlet air scrubber. This would have an additional advantage in that the inlet air would also be cooled, resulting in a higher power output on high-ambient-temperature days.

TABLE 1—SUMMARY OF EFFECTS OF CLEANING

1. Turbine inlet temperature down, °F.	53.4
2. Turbine exhaust temperature down, °F.	33
3. Fuel consumption down, std. cu. ft./hr.	1,000
4. Axial compressor speedup, r.p.m.	100
5. Blower speedup, r.p.m.	100

Since no inspection of the axial compressor blades subsequent to cleaning could be made up to the time of this writing, the erosive effect of catalyst has not yet been determined. However, it is readily apparent that catalyst cleaning presents a unique method for use with gas turbines.

Heat Balance

The gas turbine was rated at 100° F., 14.7 psia. inlet conditions, 4,880 hp., and an exhaust temperature of 905° F. Purpose of the heat and material balances was to check this rating. Information and test data needed for this examination included axial-compressor air rate, fuel consumption, inlet-air conditions, load, combustion-outlet and turbine-exhaust temperatures, and thermal efficiency. With these test data, the rated condition can be extrapolated.

The heat balance is based on the first law of thermodynamics which states that energy cannot be created or destroyed. This law applied to the gas turbine can be expressed as follows:

$$h_1 + KE_1 + q_{12} = h_2 + KE_2 + w_{12} \quad (1)$$

Where:

h_1 = enthalpy, B.t.u. per pound of fuel and air at inlet conditions.

KE_1 = kinetic energy, air at inlet conditions (value for fuel can be ignored due to small flow compared with air).

q_{12} = heat transferred in form of combustion of fuel.

h_2 = enthalpy, B.t.u. per pound, products of combustion.

KE_2 = kinetic energy, products of combustion.

w_{12} = work, B.t.u. per pound. (This value includes the base load, lube oil, convection, and radiation losses.)

The value of KE_1 is assumed to be zero. Therefore, Equation 1 can be simplified as follows:

$$h_1 + q_{12} = h_2 + w_{12} + KE_2 \quad (2)$$

Test data . . . The initial determination of the enthalpy of the atmospheric air at inlet conditions was made

(Continued on page 95)

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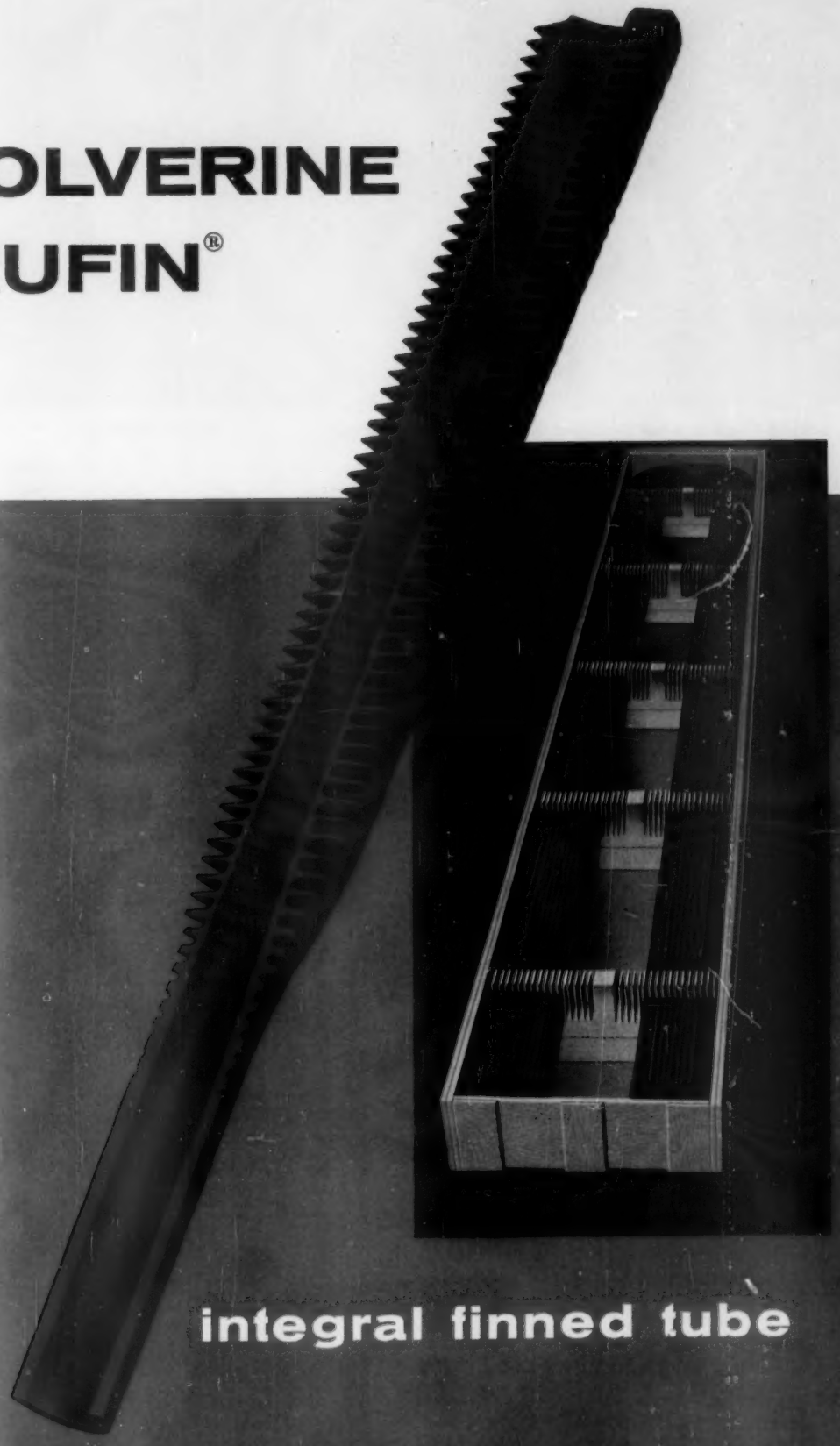

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CODE NO.	ALLOY	WT./FT. CONVERSION FACTOR (Wt./Ft. of Copper x Conv. Factor = Wt./Ft. of alloy)
01	Copper	1
25	Admiralty (Type C)	.9531
26	Admiralty (Types B & D)	.9531
28	85/15 Red Brass	.9780
30	Aluminum Brass (Type B)	.9319
40	1100 Aluminum	.3032
41	3003 Aluminum	.3065
50	Nickel	1
51	70/30 Cupro-Nickel	1
53	90/10 Cupro-Nickel	1
54	Monel	1
60	Low Carbon Steel	.8761
70	Stainless Steel	.8978

Example: ***Wolverine Trufin type S/T Catalog No. 60-195065-26***

60	19	5	065	26
TYPE S/T	FINS PER INCH	ROOT DIA. IN 1/8 OF INCH	WALL AT FIN	ALLOY

TRUFIN TYPE H/A

19 FINS PER INCH

NOMINAL SIZE	CATALOG NO.	PLAIN SECTION DIMENSIONS	
O.D.		O.D.	Wall Thk.
5/8	60-194028	.625	.042
	60-194035		.049
	60-194042		.058
	60-194049		.065
	60-194065		.083
3/4	60-195028*	.750	.049
	60-195035		.052
	60-195042		.058
	60-195049		.065
	60-195065		.083
	60-195083		.095
7/8	60-196035*	.875	.054
	60-196042		.058
	60-196049		.065
	60-196065		.083
	60-196083		.095
1	60-197042	1.000	.058
	60-197049		.065
	60-197065		.083
	60-197083		.095

TRUFIN TYPE L/C—BIMETAL

TRUFIN TYPE H/R

TRUFIN TYPE S/T

TRUFIN TYPE S/T—DUPLEX

FINNED SECTION DIMENSIONS				OUTSIDE AREA	SURFACE AREA RATIO	I.D. CROSS SECTIONAL AREA In Sq. inches	APPROX. WT./FT. LBS. (Copper)	AVAILABLE ALLOYS (See Attached Code)
Root Dia.	Wall Thk.	Inside Dia.	d_e	Sq. Ft. per Linear Ft.	ao/ai			
.500	.028	.444	.535	.405	3.48	.155	.283	01, 53, 40, 41, 50
	.035	.430			3.60	.145	.320	
	.042	.416			3.72	.136	.356	
	.049	.402			3.85	.127	.391	01, 53, 51, 40, 41, 50, 28, 25, 26, 60
	.065	.370			4.18	.108	.466	
.625	.028	.569	.660	.496	3.33	.254	.353	01, 53, 40, 41, 50
	.035	.555			3.41	.242	.401	
	.042	.541			3.50	.230	.448	
	.049	.527			3.60	.218	.493	01, 53, 51, 40, 41, 50, 28, 25, 26, 60
	.065	.495			3.84	.192	.593	
	.083	.459			4.13	.166	.697	
.750	.035	.680	.785	.588	3.30	.363	.485	01, 53, 40, 41, 50
	.042	.666			3.37	.349	.541	
	.049	.652			3.44	.334	.597	
	.065	.620			3.62	.302	.721	01, 53, 51, 40, 41, 50, 28, 25, 26, 60
	.083	.584			3.85	.268	.853	
.875	.042	.791	.910	.678	3.27	.492	.632	01, 53, 40, 41, 50
	.049	.777			3.33	.474	.699	
	.065	.745			3.48	.436	.847	01, 53, 51, 40, 41, 50, 28, 25, 26, 60
	.083	.709			3.65	.395	1.006	

*Plain lands are available on all standard Type S/T sizes except 195028 and 196035. All lands are supplied in the annealed condition. They are limited to a minimum length of one inch.

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(Continued from page 90)

possible by data supplied by the turbine manufacturer. These data consisted of four test points (pounds per second) plotted against axial-compressor speed and were qualified by atmospheric pressure, temperature, and relative humidity at the time of shop test.

During the test run in the field, the same data were recorded. A correction of shop test data was made using Dalton's law of partial pressures to arrive at the field test air rate in pounds per hour.

Since the natural-gas fuel to the turbine was metered, the enthalpy of the fuel is easily determined.

(q_{12} or the heat transferred in combustion of fuel is in this case the lower heating value of the fuel.)

Daily calorimeter tests of the natural gas were taken and on the test day, a lower heating value of 940 B.t.u. per standard cubic foot was observed.

The enthalpy of the products of combustion was based on the temperature of the exhaust gases as shown by two temperature-indicating points mounted by the turbine manufacturer.

The determination of the base load portion of w_{12} was facilitated by venturis installed in the blower inlets. By accurately measuring the inlet temperature and pressure, the exhaust temperature and pressure, the blower air rate, and using the enthalpy of the air at inlet and discharge conditions, the work performed by the compressor was determined.

Lube-oil losses were determined using the oil pump capacity and the change in oil temperature across the oil cooler. Radiation and convection losses were assumed.

Table 3 contains a summary of the calculations.

Sources of error . . . The 6.46×10^6 B.t.u. per hour difference in the heat balance was considered excessive. The source of this difference could be attributed to errors in the following:

1. Instruments. Errors in the range of 3-5% are common in industrial instruments. However, the blower venturi meter, fuel meters, and temperature and pressure indicators had been calibrated just prior to the test. Also, instrument errors may or may not be compensating.

2. Axial-compressor air rate. This one component was not measured during the test. Since turbine inlet and exhaust temperatures were higher than expected at full-load conditions, a method for field checking of air rate was required. Numerous Orsat analyses of the exhaust gas at various loads showed the exhaust gas to contain the following:

O_2	−17.0 mole %
CO_2	− 2.1 mole %
C	− 0.0 mole %

This prompted the calculation of a new air rate based on Orsat analysis and the known fuel rate. The new air rate was approximately 11,000 lb. per hour less than expected. The error of closure of the heat balance was improved to 3.3%.

In the check of the adjusted air rate based on Orsat analysis, a balance was realized in the CO_2 since the new rate was based on CO_2. However, the check showed an error of −38 moles per hour in the expected oxygen rate. This can be attributed to the Orsat analysis. The samples were taken from only one position (at vertical edge) in the exhaust duct.

Combustor outlet temperatures varied as much as 100° F. because the fuel rate was varied for the same air rate. Since laminar flow in parts of the exhaust duct can be expected, the Orsat analysis would be valid only if a traverse of the exhaust duct were made in sampling the gas. An average analysis based on area covered by each set of samples would probably be representative of the actual composition of the gas.

Temperature measurement . . . The temperature of the exhaust gas used in the heat balance was that which was indicated by two thermocouples mounted in the exhaust duct. Before the test, a traverse of the exhaust duct showed a 15° F. variation in exhaust temperature. This tends to substantiate the observation regarding laminar flow requiring a traverse for Orsat analysis.

Also, the traverse average temperature was approximately 13° F. lower than that indicated by the mounted thermocouple. This difference represents approximately 1.0×10^6 B.t.u. per hour. In future work, an eductor-type resistance thermocouple will be used to reduce the possibility of error due to radiation and convection.

This approach can be used to determine turbine performance, and is based on the following:

1. Clean axial compressor to insure optimum efficiency.

2. Accurate measurement of: (a) Fuel. (b) Exhaust temperature (by traverse). (c) Exhaust gas composition (by traverse).

3. Loss rates: (a) Sealing air (temperature and rate). (b) Lube oil. (c) Radiation and convection of turbine, load, and accessories.

TABLE 3—HEAT BALANCE OF A COMBUSTION GAS TURBINE

$$h_1 + q_{12} = h_2 + w_{12} + KE_2 \quad \ldots\ldots\ldots\ldots\ldots (2)$$

or

$$h_1 + q_{12} - (h_2 + KE_2 + w_{12}) = 0$$

$h_1 =$ 44.40×10^6 B.t.u. per hour (air) +
1.16×10^6 B.t.u. per hour (fuel)
45.56×10^6 B.t.u. per hour

$q_{12} =$ 77.79×10^6 B.t.u. per hour (heat of combustion)

$h_2 =$ 112.56×10^6 B.t.u. per hour (products of combustion)

$KE_2 =$ 0.30×10^6 B.t.u. per hour

$w_{12} =$ 12.73×10^6 B.t.u. per hour (load) +
0.40×10^6 B.t.u. per hour (lube-oil losses) +
0.20×10^6 B.t.u. per hour (radiation and convection)
13.63×10^6 B.t.u. per hour

$$[112.56 + 13.63 - (45.56 + 77.79)] \times 10^6 = 6.46 \times 10^6 \text{ or } 5.3\% \text{ error in closure}$$

Acknowledgment

During the preparation of this paper, aid and counsel were generously given by A. A. Rasmussen, of the mechanical engineering department of University of Houston, Houston, and R. P. Souther and C. A. Hansen, Humble Oil & Refining Co.

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Complexity of refinery vs. manpower

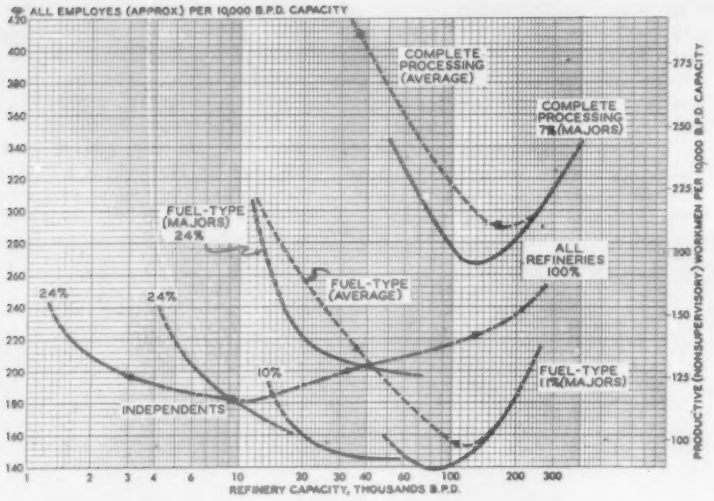
BY W. L. NELSON
Technical Editor and Petroleum Consultant

DATA on refinery employment as of April 1958 show that the number of productive workmen (mainly members of labor unions) range from 99 to 545 men per 10,000 bbl. per day capacity (see Table 1). Most of the variation is caused by differences in the complexity of the refinery operations as note the large number of employes needed by Pennsylvanian refiners.

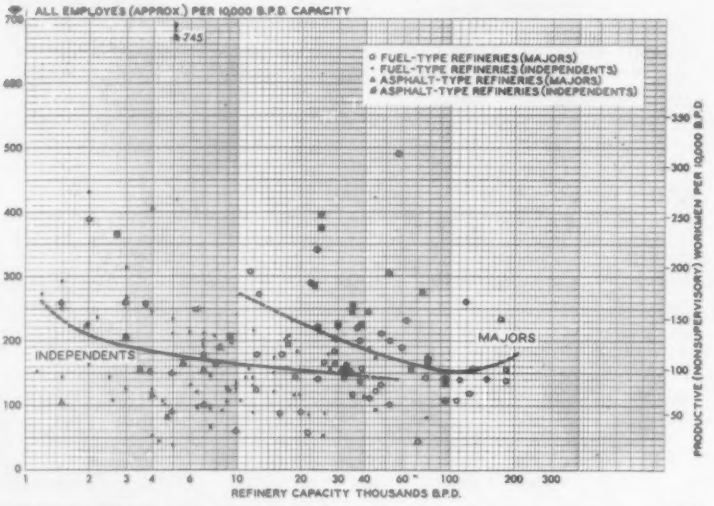
However, size is also important because the manufacture of asphalt and naphthenic lubricating oils is not particularly complicated and yet 202 men per 10,000 bbl. per day are needed by the small refiners (3,120-bbl.) who conduct such operations. These effects are also evident in Fig. 3.

Note, however, that a large capacity can also result in an increase in manpower requirements. This is especially evident in Fig. 1. Refer also to Process Costimating No. 44 (April 6, 1959, p. 158) which shows similar information for the years 1933, 1950, and 1955.

Management and production have generally been improving since (at



SUMMARY of the number of employes used by various types of refiners. (April 1958). Fig. 1.

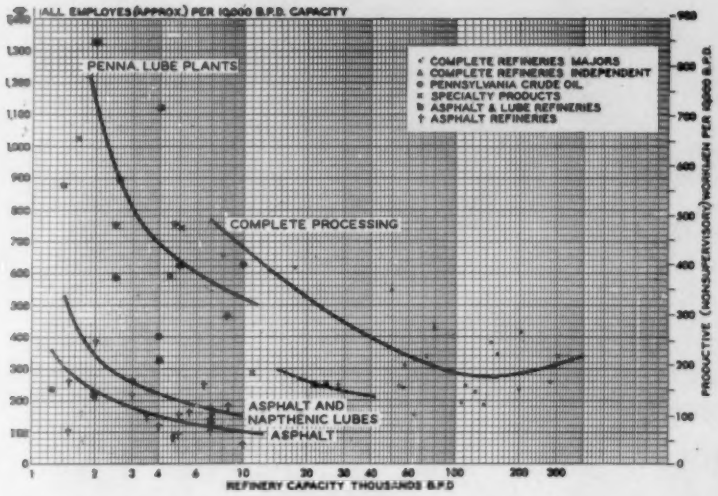


EMPLOYES USED by independent and major refiners for fuel-type (and asphalt) plants. (April 1958). Fig. 2.

TABLE 1—MANPOWER REQUIRED (APRIL 1958) FOR VARIOUS TYPES OF REFINERIES

No. of Refineries	Type of Operation—	Size, B/D (avg.)	Employes per 10,000 B/D	
			Productive	All
11	Penn. Lube Refiners	4,350	545	852
*6	Asphalt and Lube	3,120	202	316
13	Complete—Majors	162,000	186	291
†2	Complete—Independent	23,500	160	250
44	Fuel-Type—Majors	35,300	137	214
20	Fuel-Type—Majors	108,000	99	155
†19	All—Larger Independent	26,500	99	155
†18	Asphalt	4,820	101	158
*43	Fuel-Type—Independent	9,350	116	182
*43	Fuel-Type—Independent	3,155	126	197
95	All Independents§	11,500	101	158
93	All Majors	63,200	144	226
188	U. S. Average§	37,100	137	215

*Six asphalt and lube plants also included with Fuel-Type (Independents). †Two complete plants also included in All (Larger Independents). ‡Included with Fuel-Type Plants. §Excluding Pennsylvania crude-oil refiners.



INFLUENCE of complexity of refining on number of employes required. Fig. 3.

TABLE 2—AVERAGE NUMBER OF EMPLOYES IN U. S. REFINERIES SINCE 1935

	Employes per 10,000 B/D capacity—			
	1935	1950	1955	1958
Average for U. S.:				
Productive workers*	214	218	164	§137
Other employes	40	80	85	78
Total	254	298	249	215
Productivity Index†	100	85.2	102	100.3
Productive workers:*				
Major refinery management	265	‡245	180	144
Independent management	105	‡195	160	§101

*A term used by several government agencies. †See Process Costimating No. 41, Feb. 16, 1958, p. 163. ‡A slightly different basis from the other data, namely the 24 largest and the 317 smaller refineries. §Excluding Pennsylvania crude-oil refiners.

least) 1950, but the situation is not yet as satisfactory as it was in 1935. It probably never will be because petroleum refineries are now very much more complex than they were in 1935. Table 2 indicates the progress being made in productivity, and the shift from productive workers to the use of other types of employes.

The number of productive workers shown here is a somewhat precise figure but the number of other employes is less accurate for any particular plant because only the totals for the entire country are known. It is thought that the larger major refiners have more "other employes" than small refiners. Thus the differences between major and independent refiners indicated in the figures and tables are probably greater than shown.

Figs. 2 and 3 show the enormous variation in the number of employes needed by various refiners, and Fig. 3 indicates something of the effect of complexity of refining.

Complexity can be stated in terms of the various process units as indicated in Table 3, but the method cannot be applied easily unless the plants being compared have the same capacities. The various process units are weighted as in Table 3, and note that the apparently large weightings relative to crude topping are caused because auxiliary utilities and general plant facilities are included in all items except crude-oil topping.

TABLE 3—COMPLEXITY OF VARIOUS TYPES OF REFINERIES (OF THE SAME CAPACITY*)

		Capacity of Process Units Based on Topping = 100									
				Fuel-type refineries			Average refineries				
	Weighting	Asphalt refinery	Asphalt and naph. lubes	Small	Large	Fuel-type and coker	Small	Large	Complete processing	Penn. crude	Lubes from red. crude
Crude topping	1	100	100	100	100	100	100	100	100	100	....
Thermal cracking	3	17	17	12	19	16	16	15	6	9	....
Thermal reforming	3	2	2	...	2.4	2	2	2	5	7	....
Viscosity breaking	3	...	...	6	6	...	5	5	4.5	...	....
Coking	8	...	...	1.2	5.4	15	4.5	4.4	3	...	....
Catalytic cracking	4	4	7	54	52	58	43	43	45	27	45
Catalytic reforming	3	3	3	24	23	22	19	19	18	15	....
Polymerization†	4	1.7	1.3	1.6	1.4	1.7	1.2	1.2	1.8	1	1
Alkylation†	8	...	...	3.6	4.3	3.4	3.6	3.5	3.2	3.2	2.5
Hydrogen treating	4	...	...	6	18.6	20	14.3	15.2	14.3	...	....
Vacuum flashing	1	72	...	28	28	22	26.5	25.7	15	...	....
Vacuum distillation	4	...	72	...	...	...	...	...	10	35	100
Lubes and specialties†	50	...	...	...	...	...	1.9	3.8	8	23	33
Asphalt	2	30	30	3.6	...	...	2.8	2.7	2	...	10
Light-oil treating	1	41	38	48	49	53	44	41	38	34	....
Naphthenic lubes and specialties†	20	...	12	...	...	...	...	...	...	...	....
Complexity relative to topping	..	3.6	8.3	5.9	7.0	7.1	7.0	7.9	10.1	16.4	21.7
Complexity relative to average refinery	..	0.49	1.12	0.80	0.94	0.96	0.94	1.06	1.37	2.21	2.93
Capacity contemplated,* 1,000 B/D	..	5	3	20	150	80	30	150	160	4	20

*Although this table compares plants of the same capacity, it was necessary to consider typical capacities in estimating the process units employed. †Based on barrels product rather than feed.

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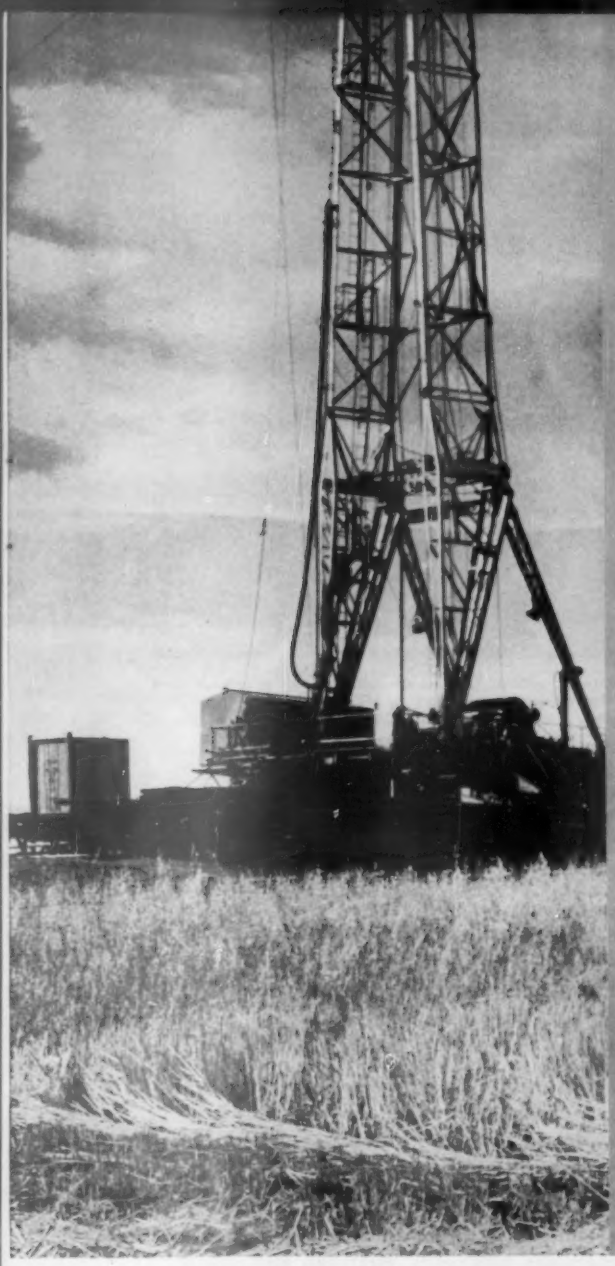

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The success of any stimulation treatment depends on both well improvement and treatment cost. Your Dowell engineer can help you tailor *low-cost* acid jobs to fit your needs.

The examples in the box above show several conditions where regular acidizing has provided satisfactory treatment.

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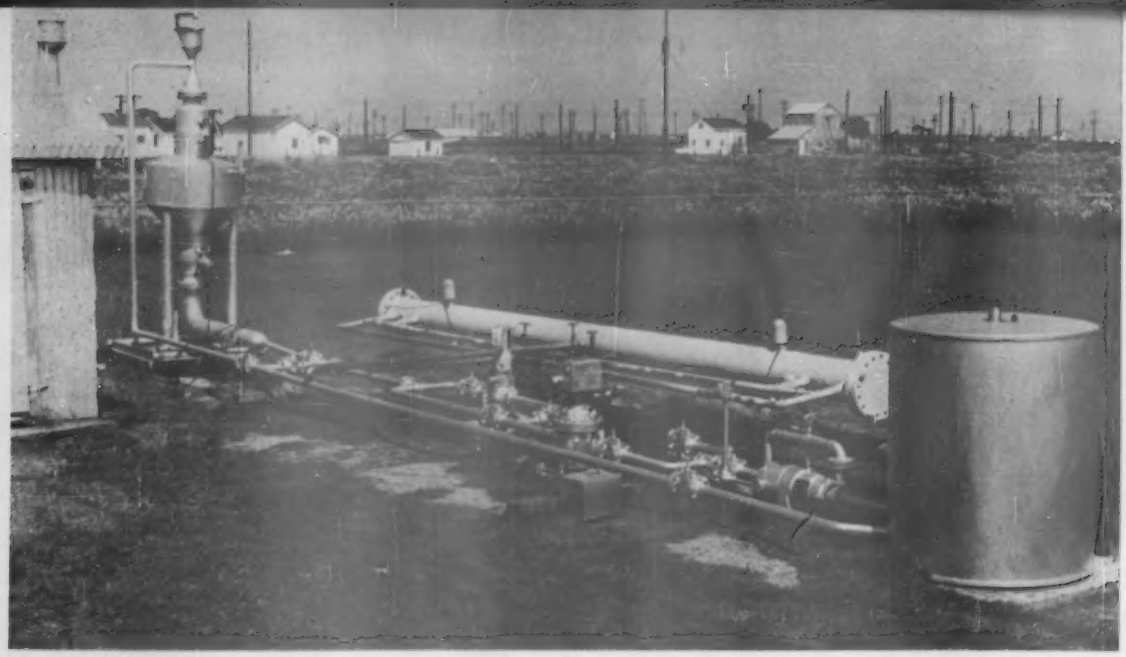


METER-PROVING LOOP has calibrated prover pipe in center rear. Volumetric prover tank is at left, and oil reservoir and circulating pump are at right. Two meters are in foreground. See Fig. 2 for diagram.

Proving systems for p.d. meters

BY R. H. PFREHM
Humble Pipe Line Co.
Houston

DURING the past few years, use of positive-displacement meters for measurement of crude oil and petroleum products has become the rule rather than the exception. With the confidence of experience, industry has now accepted meters in many phases of its operations.

One of the primary reasons for use of meters is the operating-cost advantage they provide over other methods of measurement. Because of the large savings involved in the use of meters over other measuring equipment, industry has been prone to overlook economic design in metering installations.

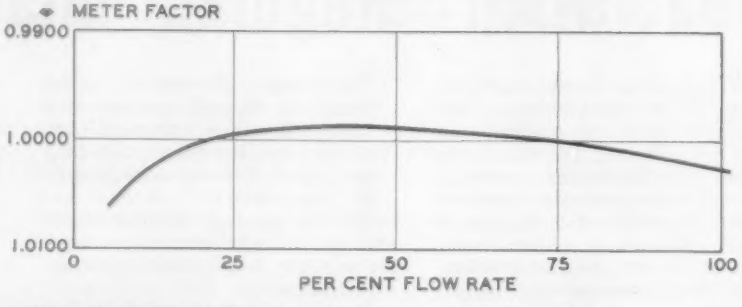
The design of a metering installation can, for all practical purposes, be broken down into two parts. First, the equipment to measure the volume of the stream and second, the equipment needed to prove or calibrate the measuring equipment. This discussion deals with the latter part, the proving equipment necessary to satisfactorily calibrate the meters.

DESIGN of a meter-proving system should allow operation without having to remove the meter from service and without stopping it. As can be observed in Fig. 1, acceleration and deceleration of the meter present in a stop-start calibration places a portion of the calibration run in the low-volume area of the curve where the slope is greatest, thus introducing inaccuracy in the meter factor determined.

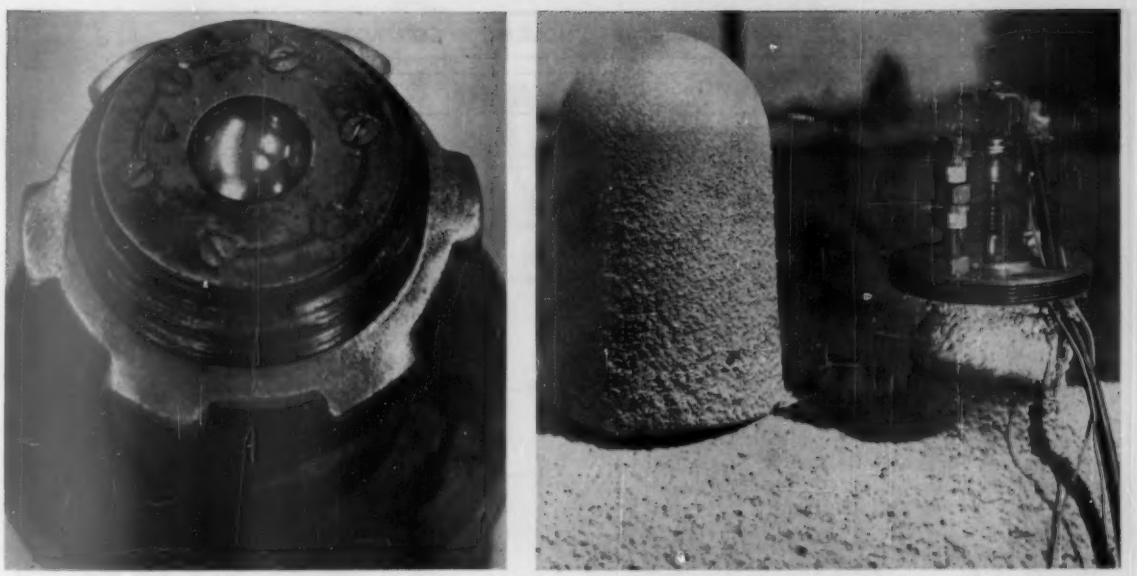
The greater the percentage of time the meter operates in the low-volume area (as compared to total calibration time) the greater will be this error. Also, by using an "onstream" calibration where the meter is not taken out of the stream, spare metering equipment for calibration purposes only is not needed.

Calibration rate . . . Calibration of a meter should be carried out at its normal operating rate and pressure. Reason for this is clear when the calibration curve is examined. The meter factor determined at one rate will not hold for another rate.

Temperature . . . Temperature of the prover volume should be as uniform



TYPICAL METER-PERFORMANCE CURVE shows that stop-start calibration introduces inaccuracy in determination of meter factor. Fig. 1.



PISTON DETECTOR SWITCH is mounted in calibrated pipe. At right, cover is removed to show microswitch. Portion inside pipe is shown at left. Piston strikes protruding sphere to close microswitch.

as possible and as near the temperature of the metered stream as possible. If the prover temperature varies from the meter temperature, the liquid will undergo a temperature change as the prover volume is filled. Because of the response time involved in most thermometers it is very difficult to determine an accurate average temperature during the calibration run. An error of 1° F. in temperature can introduce an error of .05% in meter factor.

Stabilization of prover temperature can be accomplished by designing so that the stream can be circulated through the prover volume prior to the calibration run and without any time delay between temperizing and proving.

Prover volume should be absolutely repeatable and unaffected by the weight of the liquid contained.

Costs . . . The proving system should be as inexpensive as possible consistent with acceptable accuracy. Considering piping cost a constant for most of the different systems, the major area for reducing calibration equipment costs is in the size prover volume. Amount of prover volume required is the function of a number of factors, some of which are:

1. Readability of the prover volume. Visual determination of liquid level can produce accuracy of 1/32 to 1/16 in. By use of electronic interface detectors accuracy of 1/100 in. can be had. Prover volume should be readable to 1/10,000 of the nominal volume.

2. Readability of the meter. Most meters in petroleum service are readable to 1/1,000 bbl. In order to obtain meter-factor accuracy in the range of .02% (prover accuracy of .01%) a prover volume of at least 10 bbl. would be needed. By the use of pulse generators geared to the meter and reading with an electronic counter during calibration (in addition to manual counter), readability of the meter can be increased accurately to 1/10,000 bbl, or even 1/100,000 bbl., thus reducing the size of prover volume needed for accuracy of .02%. Theoretically a prover volume of 1 bbl. could be used if the readability of the meter and prover is 1/10,000 bbl.

3. Reproducibility of the meter. This factor to a large degree dictates the amount of prover volume. If the meter is equipped with a continuous correction device the reproducibility factor of the meter will not affect the amount of prover volume needed to a large extent. If the meter is equipped with a cyclic or pulse-type correction, the amount of prover volume needed will be a function of the number of corrections to the meter occurring during the calibration run.

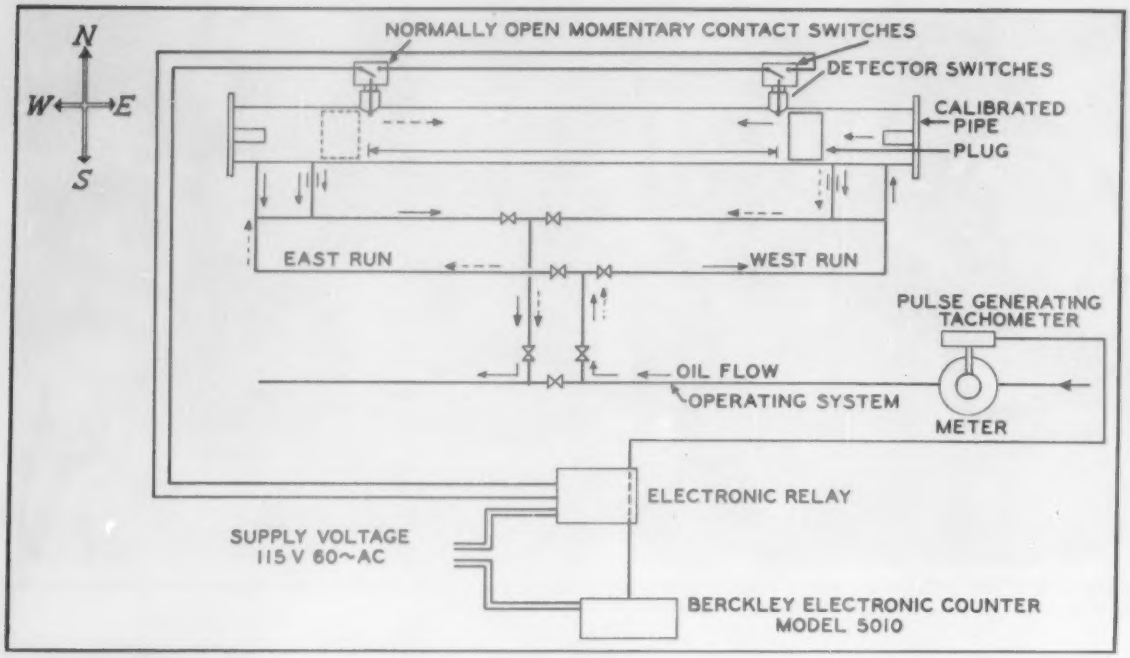
Assume a 4% correction is added to each rotation of the meter countershaft during a small portion of the rotation. The counter registers 1 bbl. per shaft rotation. Under these conditions the possible error due to the meter-correction device can be expressed as the amount of correction per unit divided by the units of prover volume.

If a 4% correction is added for each barrel registered when calibrating against a 20.5-bbl. prover, the possible error for any one calibration run would be in the range of .2% due to meter correction. In order to accurately calibrate a meter in the range of 0.02 accuracy under these conditions a minimum of 200 bbl. of prover volume would be needed regardless of the flow rate.

Speed of operation . . . The prover system should be fast in order that calibration runs can be made as quickly as possible. This feature reflects on a number of other features of a calibration system. If the system is fast it will reduce man-hours to operate, prover volume, prover cost,

THE AUTHOR

R. H. Pfrehm is supervising engineer in charge of the research and development division of Humble Pipe Line Co.'s technical department. A native Texan, he received his BS degree in electrical engineering from Southern Methodist University in 1947 and went to work for his present company upon graduation.



CALIBRATED PIPE in proving loop is manifolded so that calibration runs may be made in both directions without affecting flow through the meter. (See equipment at start of article.) Fig. 2.

and errors due to temperature variation.

The prover system should be adaptable to **automatic operation.** It would of course be desirable to have a meter prover which at the push of a button could perform the calibration procedure accurately and read out the meter factor or, better yet, adjust the meter to unity meter factor.

Prover-volume accuracy . . . Design of the prover should be such that incrustation of the walls would not occur and therefore no errors due to variation in prover volume would occur. The use of plastic coatings on the inner walls of atmospheric prover tanks has reduced this problem except where paraffin crudes are handled at low temperatures.

A possible solution to this problem would be the use of a piston in a cylinder prover which would keep incrustation cleaned from the walls.

Construction of the prover system should be rugged, foolproof, and simple to operate. It should be designed so that it does not require a technician to operate but can be handled by operating personnel. The system should be for one-man operation and fail-safe in that it will operate accurately or not at all. Equipment should be chosen for low maintenance and to withstand the treatment it will receive in oil-field service.

Flexibility . . . The prover system should be adaptable to multimeter installations. It is uneconomical to consider a separate prover for each meter. Where multimeter installations are involved, the prover should be such that it can be manifolded to serve any meter without interfering with the operation of the others.

Also, the prover should be capable of operation in all types of fluid present at the particular location. Thus, the ideal meter-proving system will provide these features:

(1) Minimum cost, (2) fast operation, (3) automatic operation, (4) accuracy of .02%, (5) simplicity, (6) flexibility, and (7) Onstream operation.

The oil industry has developed a number of meter-proving systems which incorporate one or more of the desirable features discussed. These provers are performing a good job in proving the value of metering.

. . . Volumetric proving, using calibrated tanks, is probably the most widely used system within the oil industry. It involves the use of a tank carefully calibrated so that the volume can be read accurately to at least 1/10,000 of the nominal volume. The tank is usually operated at atmospheric pressure and requires stopping the meter at the beginning and end of a calibration run. This system can be operated as an onstream type by equipping the prover tank with liquid-level detection devices.

. . . Gravimetric proving is used to minimize the errors in calibration caused by incrustation of prover-tank walls. This calibration involves weigh-

TABLE 1—CALIBRATION RUNS AT COMYN STATION

Run No.	Meter reading	Temperature	Prover volume bbl.	Meter factor
1	39.660	56.8°	39.916	1.0078
2	39.661	56.8°	39.916	1.0078
3	39.655	56.8°	39.916	1.0079
4	39.657	56.8°	39.916	1.0079
5	39.650	56.8°	39.916	1.0081
6	39.649	56.8°	39.916	1.0081
7	39.655	56.8°	39.916	1.0079
8	39.650	56.8°	39.916	1.0081
9	39.654	56.8°	39.916	1.0080
10	39.650	56.8°	39.916	1.0081
11	39.650	56.8°	39.916	1.0081
12	39.649	56.8°	39.916	1.0081

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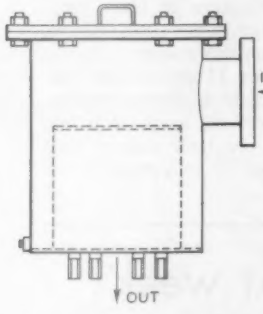

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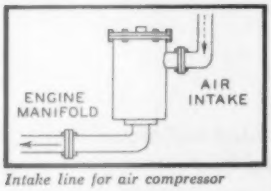
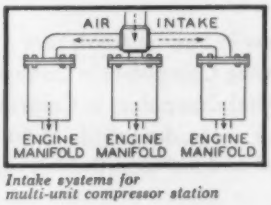


Intake line for air compressor



Intake systems for multi-unit compressor station

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ing the metered volume, converting the weight to volume, and comparing to determine a meter factor.

To accurately calibrate a meter using this system the specific gravity of the liquid must be determined to a high degree of accuracy, usually with a Westphal balance.

... Measured pipeline section is a departure from the conventional provers which is finding favor in the industry. It involves the piston in a cylinder principle and provides many desirable features. This system, developed by a major oil company, involves the use of a measured section of pipe on the up or downstream side of the meter through which a pipeline scraper or plug is run.

A measured section of the pipe is set out by tripping or detection devices at the beginning and end which are actuated by the plug or scraper. The tripping devices engage and disengage a special calibration counter on the meter thus setting out the meter measurement of the stream during displacement of the prover section.

A number of advantages are offered by the system, including on-stream calibration, normal operating rate, and elimination of errors due to acceleration and deceleration. Also the meter need not be taken out of service for calibrating.

... Master meter calibration is probably the most flexible of all in that it can be made fully portable. Calibration of the master meter is performed by using one of the standard procedures and in the same liquid for which it will be used for proving. When using this type there is some uncertainty as to whether or not the factor of the master meter has changed between provings and if the master meter was calibrated in a liquid which has the same characteristics as the liquid in which it is used as a prover.

Humble Pipe Line Co. has installed at its own Comyn station in North Texas a meter-calibration system. It is of the bidirectional piston type and involves a calibrated section of pipe in which a piston or plug is used to accurately determine an interface as it is displaced between two detection points. An electrical pulse-generating tachometer, driven by the meter, is mechanically geared to produce 1,000 to 10,000 pulses per barrel of throughput.

Detector switches are mounted near each end of the calibrated section of pipe. When the plug is displaced through the pipe it trips the first detector switch which activates an electronic relay. The relay instantaneously closes and allows pulses generated by the tachometer to be counted and recorded on an electronic counter.

The counter continues to count pulses until the plug trips the next detection switch which opens the relay, preventing pulses from reaching the counter. Volume recorded on the electronic counter represents the metered volume between the two detection points. A meter factor may be determined by comparing the barrels recorded on the counter to the known volume of the calibrated pipe after proper pressure and temperature corrections have been applied.

Referring to Fig. 2, it may be seen that the calibrated pipe is manifolded so that calibration runs may be made in both directions without affecting the flow through the meter in any way. Pipe used for the calibration section is standard line pipe selected for roundness with weld beads and burrs removed from the inner wall.

Proving of the volume between detection points of the calibrated pipe can be accomplished in a number of ways:

1. Measure the i.d. of the pipe accurately between detection points and calculate volume. The calculated volume can be checked by proving against a master meter.
2. Displace the volume between detection points using water and measure in certified cans.
3. Displace the volume between detection points using oil or product and measure in a portable prover tank.

Agreement between proving runs in both directions should be obtained for accurate proving of the calibrated pipe. To check against any leakage around the plug during operation, the system should be run against a master meter at two different rates. Since any leakage will be inversely proportional to the velocity of the plug, this procedure will detect its presence.

The calibrated-pipe system of proving offers a number of desirable features:

1. During the time a meter is being calibrated, the calibration system becomes an integral part of the operational piping. The meter remains in continuous uninterrupted service at its operating rate and pressure.
2. The system may be completely automatic for remote operation.
3. The system is adaptable to multimeter installations.
4. Since the system is entirely enclosed, it is adaptable to proving meters at any rate and pressure.
5. Temperature - correction factors may be more accurately applied because the continuous flow of fluid through the calibration system stabilizes the operating temperature of the prover.
6. Error caused by incrustation on prover-tank walls is eliminated due to the wiping action of the plug against the pipe wall.
7. A complete calibration run can be made in less than 1 minute.
8. Expensive and time-consuming pumpdown of prover tank is eliminated.
9. Cost of the calibrated-pipe system is in most cases less than the conventional prover-tank installation.
10. Potential accuracy of the system is somewhat less than 0.01%. Errors due to starting and stopping of the meter are eliminated.
11. Because of the continuous operation of the meter during calibration, spare meter for calibration purposes only is not needed.
12. Vapor pressure or other similar characteristics of the fluid metered has no effect on this system.

Table 1 shows 12 consecutive calibration runs made at Comyn station. These runs were all made at a rate of 3,600 bbl. per hour with a total elapsed time of 12 minutes.

REFINING featured next week . . .

A SPECIAL 16-page refining report on instrumentation and control will be the main attraction in the October 5 issue of the Oil and Gas Journal.

Because so much progress has been made in this field in recent years, the special report will feature these three timely topics:

√What's New in Stream Analyzers
√Use of Analog Computers in Control
√Use of Digital Computers in Control

For a helpful, up-to-date study of the latest techniques in refining control and instrumentation, read the Journal week.

Heavy crude is more attractive now

Reasons . . .

- New developments in heating oil in reservoir
- Improved pumping methods
- Better treating facilities and procedures
- Better approach to shipping problems

BY E. W. WALKER
Western Gulf Oil Co.
Los Angeles, Calif.

INCREASED importance of heavy crude in the past few years has brought many new developments that have improved recoveries and made handling problems easier.

Heavy crude oil is often considered as being anything below 20° API, but we will concentrate here on crudes below 15° API. These heavier heavy crudes present the worst production problems.

The basic heavy-crude-oil production problems are: (1) promoting flow to the well bore, (2) pumping, (3) treating, and (4) shipping.

And the conditions responsible for these problems are:

1. High crude viscosity in relation to reservoir, well bore, or normal surface operating temperatures.
2. Sand production from unconsolidated producing formations which yield heavy crudes.
3. The small density difference existing between heavy crudes and produced waters, especially when these waters are fresh.
4. Corrosive waters.

One or more of these are usually involved in the production of heavy crude, often creating costly problems.

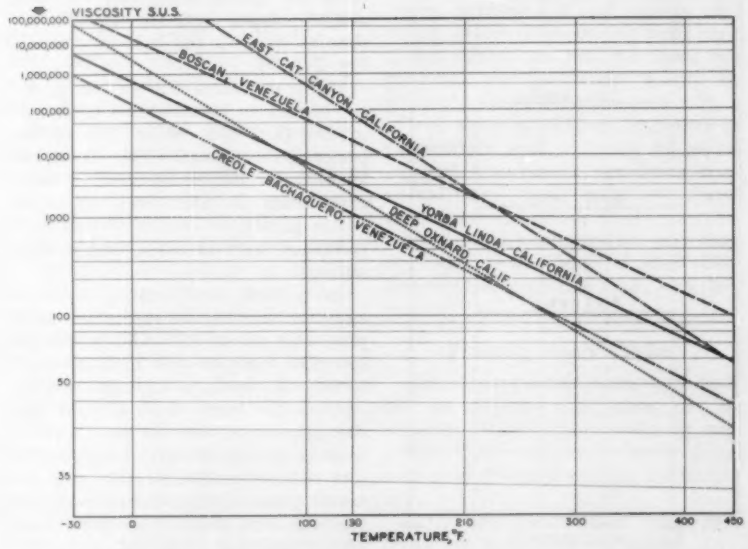
Promoting flow to well bore . . . Progress has already been made in increasing flow of heavy crudes to well bores and in increasing ultimate recovery by the application of heat in various ways. The high viscosity of heavy crudes at low temperatures retards flow into the well bore. Many heavy-crude deposits are found at relatively shallow depth where reservoir temperatures are low and little if any natural driving force exists to produce flow.

Presented at the ASME fourteenth annual Petroleum Mechanical Engineering Conference, Houston, Sept. 20-23, 1959.

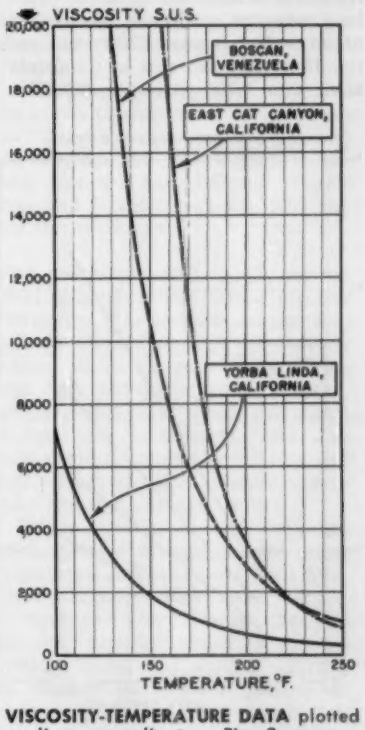
Temperature relationships . . . Fig. 1 shows typical viscosity-temperature relationships of some of the heavy crudes, plotted on semilog paper. Fig. 2 shows some of the same data plotted on linear coordinates and reveals more clearly the location on each curve where the effect of increasing temperature produces less and less change in viscosity. In Fig. 3 we have a graph showing typical relationship of earth temperature with depth for several of the fields where heavy-gravity crude is found.

If curves such as these are prepared for a heavy-crude-oil reservoir, they will indicate whether or not down-the-well heating can be expected to yield increased production.

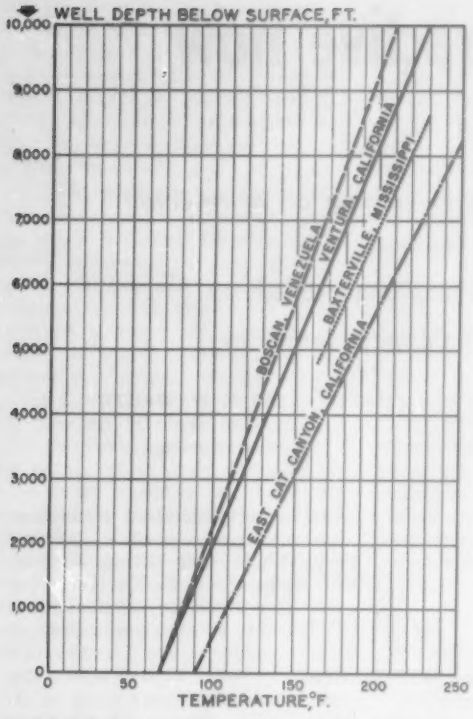
For example, a shallow (600 ft.) Yorba Linda well having a 12.8° API crude and a 45,000 S.U.s. viscosity at a reservoir temperature of 85° F. could be expected to produce better if heated, since a temperature increase of 140° F. will reduce the viscosity to about one-sixtieth of its original value. On the other hand, a deep (8,600-ft.) Baxterville well having a 13° API crude and an 80 S.U.s. viscosity at a reservoir temperature of 229° F. could hardly be expected to yield extra production with further heating. In this case, the problem is



VISCOSITY-TEMPERATURE CHART for various heavy crudes. Fig. 1.



VISCOSITY-TEMPERATURE DATA plotted on linear coordinates. Fig. 2.



TEMPERATURE at various depths below the surface. Fig. 3.

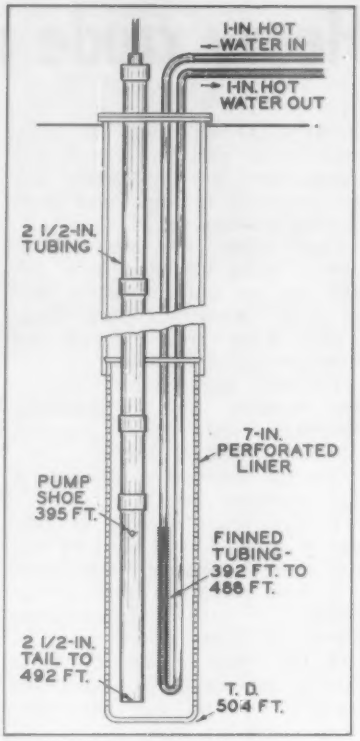
to design the pumping and gathering system to retain as much of the reservoir heat as possible.

Bottom-hole heaters . . . Under Yorba Linda-type conditions, the heating of oil wells has proved very successful. It is estimated that in California alone over 1,700 heating installations are now in use. To serve its purpose properly, a heater installation must be made at a reasonable cost and must operate economically.

From the standpoint of energy alone, the circulating-type heater seems to have advantages at shallow depths and the electric heater at greater depths. Fig. 4 shows the relationship of usable energy to depth with the two types of systems. These calculations were based on the use of 1-in. bare pipe in the circulating system. This would indicate that energy costs for the two systems with electricity at 1 cent per kilowatt and gas at 30 cents per M.c.f. would be about the same at a depth of 2,000 ft.

Improvement in thermal efficiency can be obtained by insulating the circulating lines either inside or out. One suggested approach to this is to use cement or plastic-lined circulating lines; or if bare pipe is used, to place a phenolic washer above each collar to prevent contact with tubing and casing, thus reducing conduction heat loss.

Circulating heaters work well . . . Where heat is to be exchanged with oil in the bottom of the well, several lengths of pipe with extended fin surface, preferably fins axial with the pipe, make excellent heat exchangers. If a hairpin heater is made from lengths of finned pipe, a tight U-bend can be provided at the bottom to accommodate both lines. The heating system can then be run independently of the tubing string and the well can be pumped from bottom with the shoe as high up the hole as desired, Fig. 5.

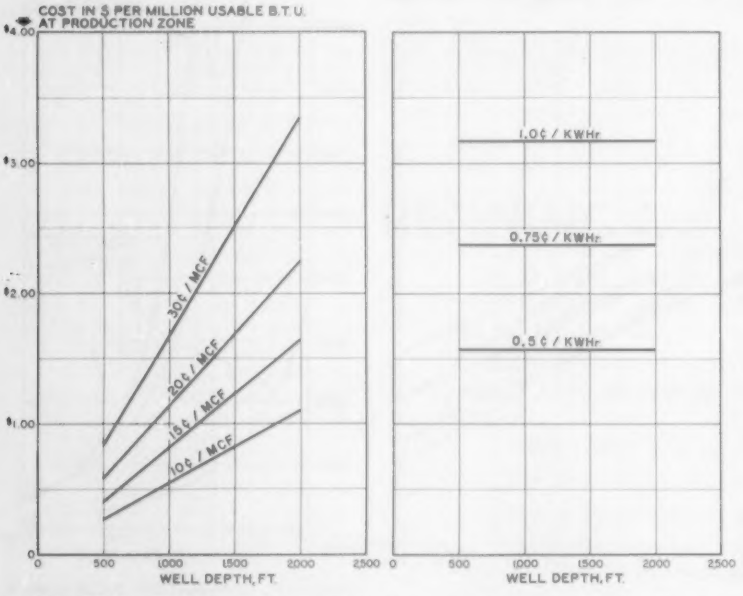

MIN. HOT WATER IN
MIN. HOT WATER OUT
2 1/2-IN. TUBING
7-IN. PERFORATED LINER
PUMP SHOE 395 FT.
FINNED TUBING- 392 FT. TO 488 FT.
2 1/2-IN. TAIL TO 492 FT.
T. D. 504 FT.

CLOSED SYSTEM for heating with circulating hot water (Yorba Linda field, California). Fig. 5.

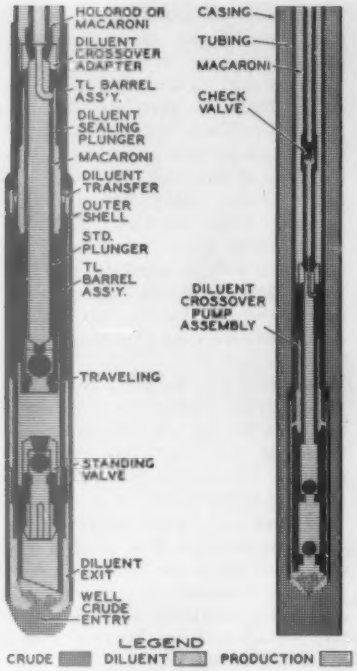
Many operators believe the greatest benefit is obtained by maintaining hot fluid over 50 to 75% of the perforated interval. The optimum location for the pump shoe in most cases must be determined by experience gained by watching well performance with different pump shoe settings.

In general, well heating is most likely to be attractive in shallow wells producing oil of 15° API gravity or less. On wells of this kind in California, the average increase in production has been 10 to 20 bbl. per day and heater payouts vary from 3 months on up. Several large operators believe optimum results are obtained when the well heaters maintain the well-bore fluid at a temperature of 150°-190° F.

Higher temperatures do not always



COST OF HEATING, per million usable B.t.u. at various well depths. Fig. 4.



DILUENT CROSSOVER pump installation. Fig. 6.

result in higher sustained production rates but substantially higher temperatures can often result in coking, scaling, and other troubles.

Sand problems . . . Running sand has been a problem in many heavy-crude areas and, where this sand is very fine, gravel packing is the most accepted method of control. With the advent of well heating, however, some operators have been able, where the sands are coarse enough, to control the sand by reducing liner slot size to about 0.030 in. Control of sand without impairing production is a very real problem in many heavy crude producing areas.

One San Joaquin Valley operator, encouraged by the increase in production from well heating, is drilling 54 new wells and working over many old wells and equipping them with heaters. Thirty of these new wells are in an old field which has already been producing for 61 years. These wells are approximately 1,100 ft. deep and cost approximately $15 per foot complete with pump and heaters. Drilling time is only 26 hours from spud to oil in the tanks.

This operator is also equipping existing wells with heaters and has found that best results are obtained by knifing operations and bailing several times before running the heater. Production decline in this field with heaters is a low 3% per year and it is felt that these wells will be producing for another 40 years.

In Situ Combustion

Experiments in the burning of oil in the reservoir to produce heat and pressure to drive fluid to well bores have been very encouraging. But high cost of air compression and high-temperature corrosion problems have prevented rapid acceptance. Ultimate recoveries can be high in the right kind of reservoir.

Recent tests in Belridge field of California, producing a 700-ft.-deep, 30-ft.-thick zone, indicate a 280-psi. air requirement of 10 M.c.f. per gross barrel or 16 to 19 M.c.f. per net barrel of oil produced. A 4 cent per M.c.f. cost for compressing air to 280 psi., based on 20 cent per M.c.f. for fuel and a 20-year depreciation charge, represents a cost of about 76 cents per barrel of oil for air compression alone. This doesn't include all the other normal costs of production and the abnormal costs due to corrosion. The most appealing aspect of this method, however, is its ability to recover a high percentage of oil from a reservoir and the ability to do this in a relatively short time.

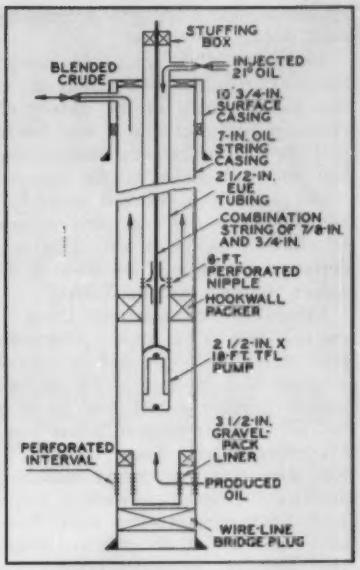
What we need now is low-cost compressed air. Perhaps large radial-type blower equipment can be used for the first stage of compression. And perhaps some of the combustion gases separated from production at elevated pressures can be recompressed and reinjected into the reservoir behind the burning front as a means of maintaining reservoir pressures and at the same time reducing compressing costs.

Corrosion expensive . . . Extreme corrosion problems in the tubing and casing strings of producing wells need to be solved. As the fire front approaches the producing wells, the produced water becomes acid with a pH of about 4. The oil increases in temperature and in gravity by about 2° API. Experiments are being conducted using special metal alloys and ceramic-coated metals in an effort to reduce the high-temperature corrosion in producing-well bores. A good solution to these problems could yield big returns.

Pumping Heavy Crudes

Some heavy-crude wells will flow but the majority need some sort of artificial lift, usually provided by rod pumps. Other methods, however, have been used where conditions are favorable.

In eastern Venezuela a major operator has three wells on gas lift. The best of the three had an initial production of 1,400 bbl. of 10.5° API crude per day from a 100-ft. sand at 7,700 ft. through 3-in. tubing, using 1,800-psi. gas. The injected gas-oil ratio is in the range of 2,500-3,000 cu. ft. per bbl. Wellhead temperature is about 110° F. The separator pressure was varied from almost 0-500 psi. with no apparent effect on production rate or injection gas-oil ratio. The well has produced 380,000 bbl. and is now producing 500 bbl. per day, with 20% water, using 1,500-psi. gas.



ANNULUS PUMPING of diluent-blended heavy crude. Fig. 7.

The poorest of the three wells had an initial production of 400 bbl. per day using 1,200-psi. injected gas with an injection ratio of 4,000 cu. ft. per bbl. This well has produced 170,000 bbl. and is still producing 370 bbl. per day of clean oil.

Rod pumps popular . . . By far the most common lifting method involves rod pumps. The problems encountered are usually due to high oil viscosity which results in poor valve action and high pumping pressures. Sand, which causes rapid wearing of pump barrels and valve parts, and corrosion which causes early pump and rod failures, are other expensive problems that must be dealt with.

Where sand and high viscosity exist, plunger fits are usually either extremely close to prevent sand from getting between barrel and plunger, or extremely wide to assure that any abrasive particles which might get between barrel and plunger will slip by without causing the plunger to stick or gall. Choice of plunger tolerance depends on well or field char-

acteristics, pump type, fluid temperature, stroke, and speed.

Maximum fluid passage through the pump requires good action of the ball valves. Early in the history of pumping heavy crudes it was found that the small clearance between the ball and the guides in the cage of 0.040 to 0.050 in. resulted in the ball hanging up in the cage, and in loss of effective pump stroke. This was corrected by using small balls in all valves pumping viscous fluids.

In addition, changes were made in the ball cage to reduce the guide surface presented to the ball to almost a line on each guide. A further change was to provide a ball stop to keep ball lift to a minimum to assure positive-acting valves. These changes in ball size and cage design increased production from many wells as much as 10 times over previous rates. They have been particularly effective where sand is present in viscous crudes.

Another attempt to improve ball-valve action is the Garbutt rod puncher. This device pushes against the standing valve ball on the downstroke to assure the valve closing, while the upper end of the rod pushes the traveling valve ball off its seat on the upstroke to assure positive valve opening.

The pump types used for viscous fluids are:

1. **Tubing liner pumps** which allow largest possible bore and valve size in relation to tubing size.

2. **Rod liner pumps** with top hold-down which allow fluid to wash directly over the seating-device area to prevent sand accumulation above the pump barrel.

3. **Rod liner pump** with traveling barrel to provide constant fluid agitation around outside of pump barrel. This pump has the traveling valve at the upper end of the pump assembly which will prevent sand from settling inside pump barrel.

4. **Tubing liner and rod liner pump** using a short barrel with long plunger and extreme close tolerance to provide continuous wiping action. The short liner barrel precludes the possibility of tight fit causing stroke loss due to frictional drag. This pump has been very successful in handling abrasive fluids.

5. **Tubing liner pump** equipped with the Garbutt rod puncher assembly, as described above, for obtaining positive valve action.

6. **Hollow-rod pumping** (either for pumping up the hollow rods or for diluent injection) is usually resorted to when other rod pumping has been proven uneconomical or impossible. When used for macaroni pumping, small tubing is used in place of solid rods. The production flows up the macaroni tubing at an increased velocity and keeps sand moving. The abrasive well fluid never reaches the upper or pickup end of the pump and thus the pump operates without sticking regardless of sand cut.

When used for diluent injection, a diluent crossover, Fig. 6, is used which transfers the diluent around the pump shell and releases it in the well fluid directly below the pump intake. This method is more often used when producing extremely viscous fluids rather than for handling sand.

Crude mixing . . . One major operator in eastern Venezuela is producing heavy crude by mixing 21°-22° API crude with the 10°-12.5° API production to make a 15° API blend. This has proved to be successful since it reduces pumping, treating, and shipping problems. Blending is done by pumping blend oil down the tubing. The tubing is set on a hook-wall packer and has a 6-ft. perforated nipple just above the packer.

Production is pumped from below the packer and commingles with the blend oil above the packer. Both leave the tubing through the perforated nipple, with the total fluid coming up the annulus between tubing and casing. This has reduced the polished-rod horsepower from 20.6 to 11.8 and the peak torque from 278,000 to 144,000 in.-lb. with the same production rate. This procedure is well established and approximately 27,000 bbl. per day are now produced in this manner, Fig. 7.

Pumping Equipment

Pumping units of all kinds and sizes are used for heavy-oil pumping, depending on requirements.

On many of the shallow, low-volume wells, short-stroke hydraulic units are becoming very popular. These smaller units are not counterbalanced and rods can drop as fast as the fluid will let them. The upstroke can be controlled as desired by controlling the speed of the hydraulic pump. These units are inexpensive and have many features that make them desirable for this application.

If well fluid cools in the tubing or if production cools in the flow lines, these units will put maximum fluid pressure under the hydraulic cylinder and hold it there until a stroke is made.

Large units . . . Large air-balanced beam units and large counterbalanced, long-stroke, hydraulic units are also commonly used for the deep, heavy-gravity wells making large volumes. These units are usually preferred for their long stroke, slow speed, and readily adjustable counterbalance.

Heavy-duty, counterbalanced, long-stroke, hydraulic units are gaining in popularity. These units automatically slow down to take a gradual pull on the rods if the well fluid has congealed in the tubing. This feature is desirable when stroking after shutdown. Some beam units have been equipped with a separate gear box which permits shifting to extremely slow speed for slow startup, but this is cumbersome and expensive.

Dilutions . . . An ideal solution to viscous-crude production is to reduce the viscosity by dilution, since this treatment helps not only the well-pumping problems but all future handling of the crude.

In some cases where well-bore temperatures are high, it is good practice to try to retain the heat and maintain the temperature. This can be done by maintaining high velocity in the tubing and by burying and/or insulating flow lines.

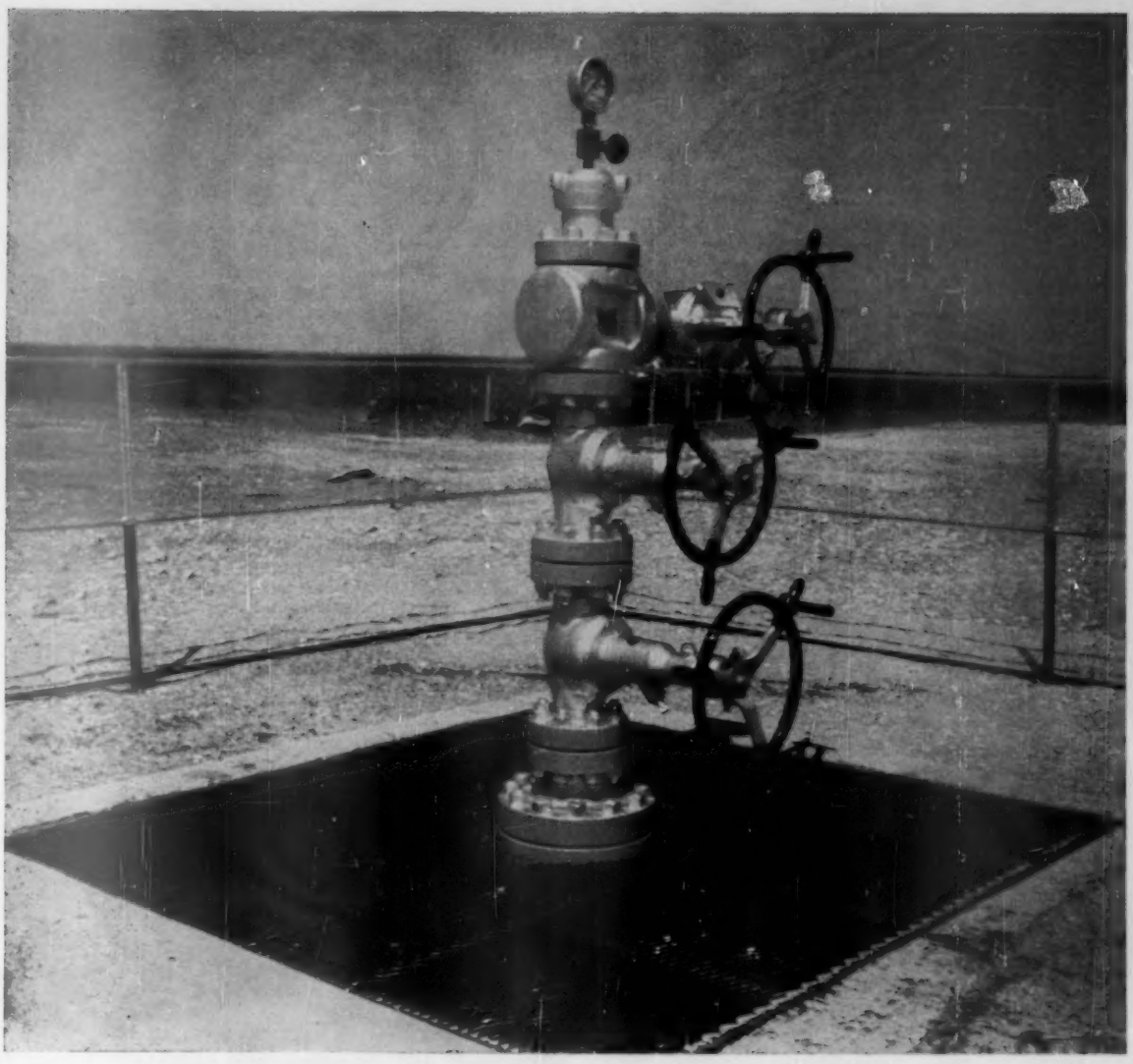
Treating Heavy Crudes

Heavy crudes present some special problems when it comes to the removal of sand, water, and gas. The specific-gravity difference between heavy crudes and water is very small. The less this difference, the less the tendency for natural separation to take place. For this reason most of these crudes can best be treated by methods which tend to increase this gravity difference and which reduce viscosity.

Heat does both and is usually employed when treating heavy crudes to aid separation, whether it be in an electrostatic or chemical treating system. As the temperature of the production is increased the viscosity of the oil decreases. At the same time, the oil density decreases while the water density remains practically unchanged, aiding gravity separation. More efficient oil-treating chemicals are constantly being developed to aid in emulsion breaking.

In California, where wholesale gas prices are currently running 23 cents per M.c.f. or higher, it is necessary to conserve heating fuel. The use of more chemical and less heat is often dictated than would be the case in an area where fuel values are lower. Reduced heat also results in reduced losses in gravity and volume. The use of fiber-board tank insulation has been proven profitable and useful, not only as a fuel saver but as a means of improving the treating operation.

Insulated tanks will retain heat longer than will bare tanks and will



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permit the coalesced water to settle out faster. Bare tanks cool so rapidly that water becomes trapped in the viscous crude as it cools and good separation cannot be obtained.

Gas removal from foaming oil can often be accomplished by the use of silicone surface-active antifoam agents and by reducing the heated crude to atmospheric pressure. These chemicals are used in very small quantities and are best applied far back in the system to get good mixing. Their use often reduces friction pressure in the gathering system in addition to reducing foam.

Ideal treating system . . . A typical heavy-crude-treating system, where fresh water, sand, and gas must be removed, might consist of a large tank receiving production from the separator. This vessel should have some means of heating and it should be equipped with water bleedoff so so that free water could be drained off. Water-cut oil would then be removed from the top of this tank through a floating suction and be transferred through extended-fin heat exchangers to raise the oil to a treating temperature, probably at or near 190° F.

This heated oil would then go to an insulated wash tank or to an electrostatic treater and then to insulated storage tanks for shipment.

It is good practice to keep the oil moving continuously through the system, adding heat until the treating is completed, then shipping continuously to take advantage of the elevated temperature and reduced viscosity.

Rapid heating . . . Where rapid heating is desired, heat exchange in the water phase is preferred. Unbalanced arrangements of heating plates or coils will create turbulence and circulation. This will help the heating but often interferes with water settling. Coils placed close to the tank bottom usually keep the tank clean above them and allow solids such as silt or sand to accumulate below.

If coils are elevated, it is not unusual for large quantities of waxes and b. s. and w. to accumulate below the coil level. This usually results in more costly tank-cleaning operations. Heat exchangers consisting of finned pipe inside larger pipe are very effective when transferring heat to heavy crude. These exchangers should be operated at turbulent flow velocities and should be constructed to provide self cleaning, avoiding traps for the accumulation of silt and sand.

Plan ahead . . . When planning a treater facility, an effort should be made to provide for logical plant enlargement with minimum piping changes. Allow room for additional separator tanks and heaters; take advantage of gravity flow by grade separation or tank height differences; use cone bottoms for easy cleaning; and provide manifold piping for transferring oil and water from tank to tank for recirculation or for cleaning.

Shipping Heavy Crude

Problems of shipping are usually those associated with low temperatures and high viscosity. What type of line should be provided: buried, buried and insulated, surface laid bare, surface laid insulated; should heating be provided; how big should the line be; should attempts be made to blend with lighter oil; should water be injected to reduce viscosity; should provisions be made to flush the line with water or lighter crude before a prolonged shutdown; and what type of pumps should be provided?

The final decisions to these questions will depend on a careful evaluation of weather conditions, distances, terrain, volume and viscosity, type of flow whether continuous or intermittent, and all the other pertinent circumstances.

Examples . . . Here are two extremes in pipelining procedure,—both in Venezuela where average ambient temperatures are in the 78° to 80° F. range the year round:

In Boscan field of western Venezuela, the temperature of the produced crude is approximately 120° F. This reaches the gathering station at approximately 80° F. where it is heated to 220° F. by means of steam coils. From the gathering tanks the oil is shipped through 8 and 10-in. lines to a reheating station located at the start of the shipping line. Here the heaters receive the oil at 160° F. and reheat to 220° F. This heat maintains the apparent viscosity of the crude low enough to pump it through the 25-mile-long 18-in. pipeline to the marine terminal where it arrives at about 160° F.

The shipping line is buried and insulated with glass fiber. By raising the initial temperature from 180° to 220° F., the need for an intermediate heating station was eliminated. At the Marine Terminal on Lake Maracaibo the oil is maintained at temperatures between 160° and 180° F. by utilizing waste exhaust steam from a nearby refinery.

The other example of shipping procedure is of an installation in eastern Venezuela between Temblador and the Caripito refinery 92 miles away on the San Juan River. The design was based on a minimum temperature of 75° F. and a viscosity of 60,000 S.U.s. for the 11° API crude. It was decided to construct a 30-in. diameter, unheated, uninsulated line, located above-ground. In making calculations, temperature and the corresponding crude viscosities were computed at points 2 miles apart for the entire line, using an over-all coefficient of heat transfer of 2 B.t.u. per sq. ft. per hour per degree Fahrenheit of temperature differential.

In this case, using the most economical diameter for the heated line, it would be possible to reduce the size of an above-ground line to 22-in. diameter; however, the cost of the crude-burning heater stations would be greater than the saving realized by reducing the line size. A smaller buried line with fewer heaters was considered but, although it showed some saving in first cost, the operating and maintenance costs would have been higher.

Water injection was also considered and tests made in a 1,000-ft. loop of 4½-in.-diameter pipe showed a pressure drop from 214 to 11 psi. between pumping 2,400 bbl. per day of clean, 13.4° API crude of 17,000 S.U.s. at 90° F. and when pumping the same amount of the same crude cut with water. Although this shipping procedure would have resulted in a minimum-cost line, even with the dehydrators required at the end of the line, it was decided to install the larger 30-in. line due to uncertainties regarding the emulsion-forming problems which might have been encountered during the 92-mile shipment.

The proper application of equipment, the right selection of facilities, the utilization of waste heat, the use of insulation, and the selection of good operating techniques can result in operating savings and lower production costs for years to come.

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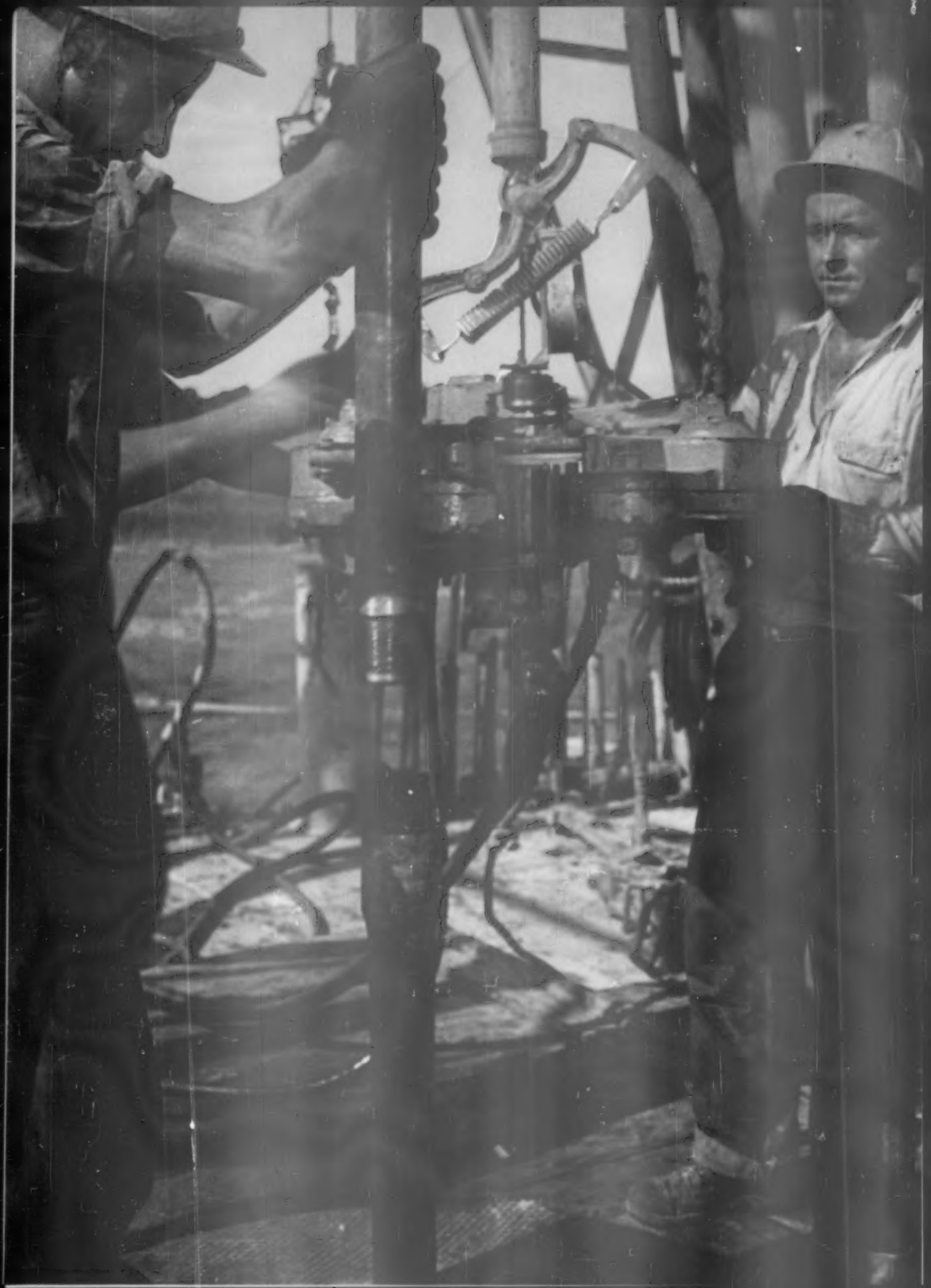


Why SPANG Extreme Line Tubing is best for deep, high pressure wells

Name the tubing features you need for profitable completions in deep, high pressure wells—and you'll find that Spang Extreme Line Tubing has every one! Take make-up and running speed, for example. Wide, rugged, modified Acme threads provide fast joint make-up with minimum possibility of cross threading and maximum speed in running. Couplings are eliminated, and the integral type joint of Spang Extreme Line reduces threaded connections 50%.

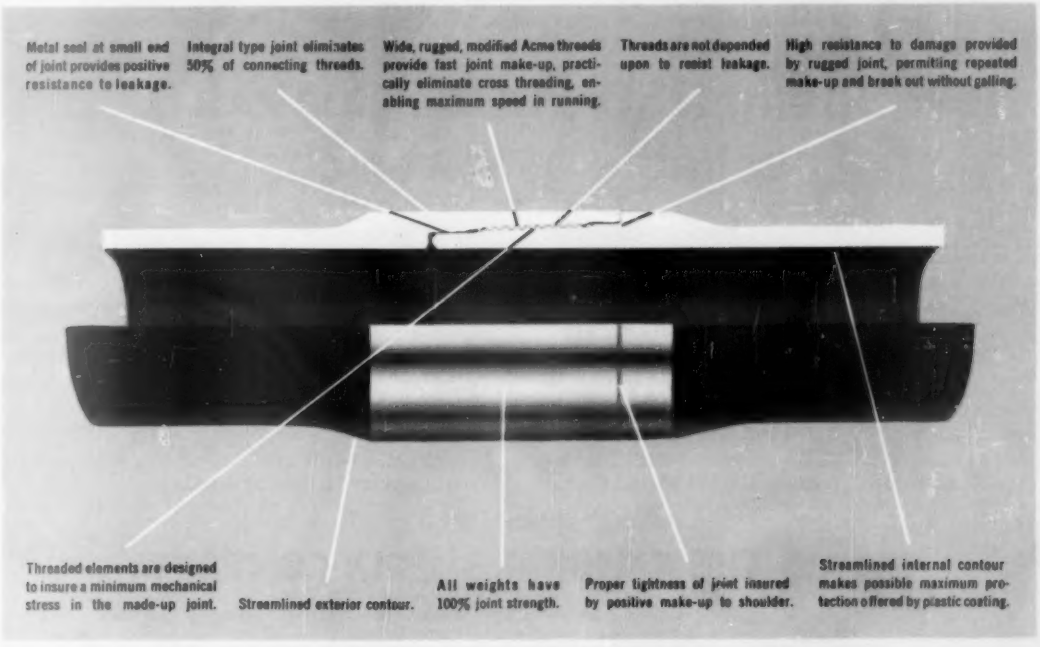
Need 100% leakage resistance? You get it with Spang. Male and female members make up into a sealed joint that is shoulder tight, and this unique seal resists leakage even under extreme conditions. The Spang Extreme Line joint is streamlined internally and externally with a minimum outside diameter.

Because of its streamlined exterior, Spang Extreme Line greatly minimizes the possibility of hanging up when running or stripping under pressure. The joint strength is 100% in all weights—its ruggedness permits repeated making up and breaking out without galling.

Spang Extreme Line Tubing is available in grades J-55, N-80, and P-105 to meet every well condition, and—if you anticipate paraffin accumulation or corrosion problems—you can order Spang's plastic coating to combat it (more about this on the next page). Spang Extreme Line Tubing is especially suited for deep, high pressure wells.

Next time you need tubing, be sure you get the best. Buy Spang Extreme Line Tubing or Spangseal Tubing.

Couplings are eliminated in this superior, 100% leak-resistant joint!


Metal seal at small end of joint provides positive resistance to leakage.
Integral type joint eliminates 50% of connecting threads.
Wide, rugged, modified Acme threads provide fast joint make-up, practically eliminate cross threading, enabling maximum speed in running.
Threads are not depended upon to resist leakage.
High resistance to damage provided by rugged joint, permitting repeated make-up and break out without galling.
Threaded elements are designed to insure a minimum mechanical stress in the made-up joint.
Streamlined exterior contour.
All weights have 100% joint strength.
Proper tightness of joint insured by positive make-up to shoulder.
Streamlined internal contour makes possible maximum protection offered by plastic coating.

On the next page: New SPANG Red Plastic Coating for Tubing!

The joint design of Spang Extreme Line Tubing insures fast make-up, with minimum possibility of cross threading and maximum speed in running. Joint strength is 100% in all weights.

The new red plastic coating is approximately half as thick as the familiar green which has been used successfully for a number of years. National has the only mill facility of its kind for the unified control of tubular goods and plastic coating.

New Spang RED Plastic Coated Tubing available at lower cost!

You asked for a lower cost Spang Plastic Coated Tubing to minimize paraffin deposits—and here it is. Spang RED Plastic Coating is made of the same tough epoxy-phenolic plastic as the familiar GREEN. The only difference is that it's approximately half as thick as the GREEN.

Like the thoroughly proven GREEN coating, the new RED coating is applied to a shot-blasted surface by alternate spraying and baking until the lining of predetermined thickness is obtained. The result is a hard, smooth lining which effectively resists paraffin deposition. (Field experience shows SPANG Plastic Coated Tubing eliminates 50% to 75% of the costly paraffin removal jobs required when uncoated tubing is used.)

We will continue to supply the GREEN coating. It costs more, but it's still the best investment for severe corrosive conditions. To give special protection to the joint sealing area in Spang Extreme Line Tubing, a Teflon corrosion barrier sealing ring is used. This ring completely closes the space between the end of the male member and the inner shoulder at the depth of the female member of the joint. The National Representative in your area can furnish full details.

THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

TWO GATEWAY CENTER, PITTSBURGH, PA.

DIVISION OFFICES: Calgary, Dallas, Denver, Houston, Toledo, Torrance, Tulsa

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Monthly Report on PIPELINE CONSTRUCTION

PIPELINE ACTIVITY reported here is compiled from surveys by The Oil and Gas Journal among pipeline companies and construction contractors.

This summary report appears in the last issue of the Journal each month. New construction projects are reported weekly in Pipeline Briefs in the Journal's news section.

Projects are listed in three groups —U. S., Canadian, and Foreign— and according to type of line—crude, products, or natural gas.

U. S. Crude Oil Pipelines

• **Buckeye Pipe Line Co.,** New York.
Project: 2 miles of 12-in. from Mantua to Warren, Ohio.
Status: Under way.
Contractor: **H. L. Gentry Construction Co.,** Jackson, Mich.
Completion: October 1959.

• **Cape Pipe Line Co.** (Sun Oil Co., Cities Service Co., Atlantic Refining Co.), Philadelphia.
Project: Line from lower Delaware Bay to Philadelphia.
Status: Planned.
Completion: 1960.

• **Cooperative Refinery Association,** Kansas City, Mo.
Project: 6 miles of 6-in. at Stockton, Kans.
Status: Planned.
Completion: Spring 1960.

• **Gillette Pipeline, Inc.,** and **A. W. Hartwig, Inc.**
Project: A 102-mile line from Dead Horse Creek field to Casper, Wyo.
Status: Pending Wyoming Public Service Commission approved.

• **Great Northern Railway Co.**
Project: 400 to 600 miles of 12 to 20-in from Williston basin in Mont. and N. D., to Clearbrook or St. Paul, Minn.
Contractor: **Pipe Line Technologists, Inc.,** Houston, has completed feasibility study.

• **Honolulu Oil Corp.** and six other companies.
Project: 28-mile crude line connecting Fourbear, Pitchfork, and Spring Creek fields in Wyoming.
Status: Pending approval of state public service commission.

• **Husky Oil Co.,** Cody, Wyo.
Project: Gathering lines to the refinery at Cody.
Status: Planned.

• **International Oil Pipeline Corp.,** New York City.
Project: Would own U. S. section of 1,500-mile, 30-in. line proposed by Mid-Continent Pipe Lines, Ltd., from Edmonton, Alta., to Chicago. (See Canadian Crude-Oil Pipelines).
Status: Proposed.

• **Mid-Continent Pipe Line Co.,** Tulsa.
Project: 100 miles of 3, 4, and 6-in. gathering line and trunk line to connect Northeast Cherokee, Mendon, West Mendon, Eureka, and North Roundhill fields in northwestern Oklahoma.
Status: Under way.
Contractors: **Jess Whitlow,** Ponca City, Okla., has contract for the gathering line, and **A. C. Holder Construction Co., Inc.,** Tulsa, has contract for the main line.
Completion: Nov. 1, 1959.

• **Northern Pipe Line Co.,** New York.
Project: About 4 miles of 12-in. from Ohio state line to Simpson, Pa.
Status: Under way.
Contractor: **H. L. Gentry Construction Co.,** Jackson, Mich.
Completion: Fall 1959.

• **Ohio Oil Co.,** Findlay, Ohio.
Project: 60 miles of 8-in. between Scipio field in Michigan and Buckeye Pipe Line Co.'s terminal south of Toledo, Ohio, and a 20-mile spur north into Pulaski and Albion fields.
Status: Planned.

• **Service Pipe Line Co.,** Tulsa, Okla.
Project: About 5 miles of 3, 4, and 6-in. line at North Sandy Bend pool, Union County, Arkansas.
Contractor: **Snelling Co.,** Shreveport, La.
Completion: Dec. 31, 1959.

• **Standard Oil Co. of California,** San Francisco.
Project: Four lines to handle production from a platform 2.2 miles off coast of Summerland, Calif. Three of the lines will connect the platform and onshore tanks, and a 20-in. line will connect tanks to an offshore tanker mooring.
Status: Under way.
Contractor: **Morrison-Knudsen Co.,** San Francisco, Graver Tank & Manufacturing Co., and others.
Completion: Jan. 1, 1960.

• **Teton Pipeline Co.,** Denver.
Project: 8 miles of 5-in. to connect O'Brien field, Carbon Co., Wyo., with the Sinclair Pipe Line system.
Status: Planned.

• **Texaco-Cities Service Pipe Line Co.,** Tulsa.
Project: About 12 miles of 12-in. in Oologah Dam area, northeastern Oklahoma.
Status: Planned.
Contractor: **O. R. Burden Construction Corp.,** Tulsa.

• **Texas Gas Transmission Corp.,** Owensboro, Ky.
Project: 19½ miles of 3½-in. line off Louisiana coast.
Status: Planned.

U. S. Products Pipelines

• **Badger Pipe Line Co., Bartlesville, Okla.**
Project: 2½-miles lateral from main Badger line to O'Hare Air Field in the Des Plaines, Ill., area near Chicago.
Status: Under way.
Completion: December 1959.

• **Continental Pipe Line Co.,** Ponca City, Okla.
Project: 155 miles of 6-in. from Artesia, N.M, to El Paso, Tex.
Status: Under way.
Contractor: **R. H. Fulton & Co.,** Lubbock, Tex.
Completion: Dec. 1, 1959.
Project: 9 miles of 16-in. at Lake Charles, La.
Status: Under way.
Contractor: **Bill Murry & Co.,** Beaumont, Tex.
Completion: Oct. 15, 1959.

• **Florida Pipeline & Storage Co.,** Uniontown, Pa.
Project: 54 miles of 8-in. from Port Everglades to Homestead Air Force Base, Fla.
Status. Under way.
Contractor: **Ewin Engineering Corp.,** Washington, D.C., has engineering supervision contract.
Completion: Nov. 1, 1959.

• **Great Lakes Pipe Line Co.,** Kansas City, Mo.
Project: 64 miles of 12-in. from Iowa City to Princeton, Iowa, and 62 miles of 12-in. from Cordova to Lee Center, Ill.
Status: Under way.

• **Husky Oil Co.,** Cody, Wyo.
Project: Line from Cody to the Yellowstone products line west from Billings, Mont.
Status: Planned.

• **Kaneb Pipe Line Co.,** Houston.
Project: 111 miles of 6-in. from Phillipsburg, Kans., to Fairmont terminal near Geneva, Neb., and 168 miles of 6-in. from Fairmont to Yankton, S.D.
Status: Under way.
Contractor: **Williams Brothers Co., Tulsa.**
Completion: Fall 1959.

• **Missouri-Kansas-Texas Railroad.**
Project: 1,400 miles of LPG line from West Texas to the upper Midwest. The line would originate between Midland and the New Mexico border and would fork at McPherson, Kans. One branch would go to the Minneapolis area, and the other to the Madison, Wis., area.
Status: Proposed.

• **Southern Pacific Pipe Lines, Inc.,** Los Angeles.
Project: 2.4 miles of 8-in. from Texaco and Time Oil Co. facilities to receiving pump station at Richmond, Calif.
Status: Under way.
Completion: Oct. 20, 1959.

• **Wabash Pipe Line Co.,** Findlay, Ohio.
Project: 29 miles of 12-in. and 9 miles of 16-in. from Griffith, Ind., to Lake Calumet, Chicago, Ill.
Status: Under way.
Contractors: **Morrison Construction Co.,** Hammond, Ind., and **Contracting & Material Co.,** Evanston, Ill.

U. S. Natural Gas Pipelines

• **Algonquin Gas Transmission Co.,** Boston, Mass.
Project: 26-in. line in vicinity of Danbury, Conn.
Contractor: **A. J. Curtis & Co.,** Hickory, Pa.
Completion: October 1959.
Project: 6 miles of 20-in. from Mendon to Wrentham, Mass.

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Status: Planned.
Contractor: **Construction Service Co.**, Bound Brook, N. J.
Completion: Before winter.
Project: 3 miles of 8-in. in Freetown, Mass.
Status: Planned.
Completion: Before winter.
Project: 2 miles of 6-in. from Longmeadow, Mass., to Thompsonville, Conn.
Status: Under way.
Constructor: **Hallen Construction Co., Inc.**, Island Park, N. Y.
Completion: Oct. 1, 1959.

• **Arkansas Industrial Pipeline Corp.** (Arkansas Louisiana Gas Co.), Shreveport, La.
Project: 130 miles of 18-in. from Perla to Helena, Ark.
Status: Planned.
Completion: 1959.

• **Arkansas Louisiana Gas Co.**, Shreveport, La.
Project: 3 miles of 2-in., 58.5 miles of 4-in., and 2 miles of 6-in. gathering line.
Status: Planned in 1959.
Project: 77.4 miles of 6-in. transmission lines.
Status: Planned in 1959.

• **Atlantic Seaboard Corp.**, Charleston, W. Va.
Project: 19.8 miles of 26-in. loops in West Virginia and Virginia.
Status: Under way.
Contractor: **Gentry, Kaighen, & Hughes.**
Completion: November 1959.

• **Central Hudson Gas & Electric Corp.**, Poughkeepsie, N. Y.
Project: 13 miles of 10-in. from Highland to Kingston (Part II), N. Y.
Status: Panned.
Completion: 1960.
Project: 3.4 miles of 8 and 6-in. from Fishkill to Frinkerhoff.
Status: Under way.
Contractor: **C. N. Flagg & Co., Inc.**, South Meriden, Conn.
Completion: November 1959.

• **Chicago District Pipeline Co.**
Project: 50 miles of 36-in. from Joliet to Chicago.
Status: Under way.
Contractor: **Contracting & Material Co., Evanston, Ill.**
Completion: Fall 1959.

• **Coastal States Gas Producing Co.**, Corpus Christi, Tex.
Project: 49 miles of 18-in. and 55 miles of 20-in. from Kelsey Base (Brooks) to Rodriguez field, La Salle County, Texas.
Status: Planned.
Contractor: **O. R. Burden Construction Corp., Tulsa.**
Completion: Dec. 1, 1959.
Project: 60 miles of 10-in. in La Salle and Frio counties, Texas.
Status: Planned.
Completion: Jan. 1, 1960.

• **Colorado Interstate Gas Co.**, Colorado Springs, Colo.
Project: 109 miles of 26-in. from Four-Way station in Tex. Panhandle, to Morton Junction in southeastern Colo.; 135 miles of 34-in. from there to Pueblo, and 100 miles of 30-in. on to Denver; 148 miles of 34-in. from CIG line at Rock Springs, Wyo., to Provo, Utah, to connect with proposed El Paso Natural aGs Co.'s line to Calif.
Status: Planned.
Completion: January 1, 1961.

• **Colorado Oil & Gas Corp.**, Denver.
Project: 402-mile line from Gubik field to Fairbanks, Alaska.
Status: Proposed.

• **Columbia Gulf Transmission Co.**, Houston.
Project: 11 miles supply line connecting Black 17 field, East Cameron area, La.
Status: Approved.
Project: 10 miles of 12-in. supply loop to Erath field, Vermilion Parish, La., and 9 miles of various-size field lines in Acadia and Vermilion parishes, La.
Status: Approved.
Project: 10 miles of 20-in. loop in Jefferson Davis and Vermilion parishes, La., and 3 miles of 6-in. loop in Cameron Parish, La.
Status: Approved.
Project: 41 miles of 24-in. loop of east lateral in vicinity of Rayne, La.
Status: Approved by FPC.
Completion: Fall 1959.

• **Consumers Power Co.**, Jackson, Mich.
Project: 120 miles of 26-in. from Mich.-Ind. border connection with Trunkline Gas Co., to Plymouth, Mich., and 20 miles of 24-in. from Northville to Clarkston, Mich.
Status: Under way.
Contractor: **Cape Construction Co., Inc.**, Cape Girardeau, Mo.
Completion: Jan. 1, 1960.

• **East Ohio Gas Co.**, Cleveland.
Project: 75 miles of 18-in. in Harrison, Mahoning, Columbiana, Carroll, and Belmont counties, Ohio.
Status: Under way.
Contractor: **Sharman, Allen, Gay & Taylor, Inc.**, Houston.

• **El Paso Natural Gas Co.**, El Paso, Tex.
Project: 34.2 miles of 20-in. from Puckett, Tex., to Goldsmith plant; 51.3 miles of 20-in. from Terrell to Puckett Plant discharge; and 23 miles of 20-in. from Goldsmith to Eunice-Dumas line.
Status: Planned.
Completion: January 1960.
Project: 244 miles of 30-in. Permian-San Juan Line loops.
Status: Planned.
Completion: January 1960.
Project: 87 miles of gathering lines in Bisti field in San Juan Co., N. M.
Status: Has temporary FPC approval.
Project: 62-mile gathering system of 4½-10-in. in Beaver County, Okla.
Status: Pending FPC approval.
Completion: Fall 1959.
Project: 395 miles of 34-in. from Salt Lake City, to Calif. border near Las Vegas, Nev.
Status: Pending FPC approval.
Completion: January 1, 1961.

• **Equitable Gas Co.**, Pittsburgh.
Project: 13.4 miles of 16-in. in W. Va.
Status: Under way.
Contractor: **Harford Brothers**, Emporium, Pa.
Completion: Oct. 1, 1959.
Project: 15.3 miles of 16-in., 3 miles of 20-in. in W. Va. and Pa.
Status: Planned.
Completion: Fall 1960.
Project: 14.7 miles of 16-in., 5.9 miles of 20-in. in Pa.
Status: Planned.
Completion: Fall 1961.
Project: 17.25 miles of 20-in. in Pa.
Status: Planned.
Completion: Fall 1962.

• **Gulf Resources, Inc.**, New York.
Project: 136 miles of 14 and 20-in. from Hidalgo County to LaSalle County, Texas.
Status: Pending FPC approval.

• **Hope Natural Gas Co.**, Clarksburg, W. Va.
Project: 20 miles of 24-in. line in Wetzel and Monongalia counties, W. Va., replacing two 16-in. lines.
Status: Approved.
Project: 45-mile line from W. Va. to Pittsburgh area.
Completion: Fall 1959.

• **Iron Ranges Natural Gas Co.**, St. Paul.
Project: 79 miles of 10 and 12-in. from Grand Rapids to Hoyt Lake, Minn., and 67 miles of 12-in. from Duluth to Silver Bay, Minn.
Status: Approved by FPC.
Completion: Fall 1959.

• **Iroquois Gas Co.**
Project: 9.5 miles of 16-in. in Erie County, N. Y.
Status: Pending FPC approval.

• **Kansas-Nebraska Natural Gas Co., Inc.**, Phillipsburg, Kans.
Project: 15.5 miles of 12-in. loop in northwestern Kansas.
Status: Under way.
Contractor: **Cheek Construction**, Ulysses, Kans.
Completion: Oct. 1, 1959.
Project: 10 miles of 4-in. from Goodrich, Colo., to Riverside field.
Completion: Oct. 15, 1959.
Project: 4 miles of 8-in. from Atwood, Colo., to Sterling.
Completion: Oct. 30, 1959.

• **Laclede Gas Co.**, St. Louis, Mo.
Project: 107 miles of 24-in. between Hallsville, Mo., and St. Louis.
Status: Proposed.

• **Lone Star Gas Co.**, Dallas.
Project: About 7 miles of 10-in. lateral from North Doyle dehydration plant in Stephens County, Oklahoma, to Carter-Knox field, Grady County.
Status: Planned.

• **Lone Star Gas Co.** and **Coastal States Gas Producing Co.**
Project: 37 miles of gathering line in North Texas.
Status: Planned.

• **Manufacturers Light & Heat Co.**
Project: 61 miles of 20-in. (to replace 135 miles of old 6-in.).
Status: Under way.
Contractor: **Harford Bro.**, Empolium, Pa.
Completion: Fall 1959.
Project: 10.4 miles of 8-in. replacement from Uniontown to Connellsville, Pa.
Status: Planned.
Contractor: **Wilkie Contracting Co.**
Completion: Sept. 30, 1959.

• **Michigan Wisconsin Pipe Line Co.**, Detroit.
Project: 20 miles of 16-in. loop in Wisconsin.
Completion: Oct. 1, 1959.
Project: 134.4 miles of 24-in., 27.9 miles of 20-in., 96.3 miles of 16-in., and 118 miles of smaller diameter lines, in Wisconsin and Michigan.
Status: Pending FPC approval.
Completion: 1960.

• **Midwestern Gas Transmission Co.**, Houston.
Project: 350 miles of 30-in. from Portland, Tenn., to Joilet, Ill.
Status: Under way.
Contractors: **Sharman, Allen, Gay & Taylor, Inc.**, Houston; **Panama, Inc.**, Houston; **Majestic Contractors, Ltd.**, Edmonton, Alta.; **Bechtel Corp.**, San Francisco; **Grayco Constructors, Inc.**, Austin, Tex.; **Pentzien, Inc.**, Omaha, Neb.; **Collins Construction Co.**, Port Lavaca, Tex.; **Missouri Valley Dredging Co.**, Omaha, Neb.; and **Popich Marine Construction, Inc.**
Completion: Fall 1959.
Project: 504 miles of 24-in. from Emerson, Man., to Marshfield, Wis., plus 54 miles of sales laterals.
Status: Pending FPC approval.
Completion: 1960.

• **Mississippi River Transmission Corp.** (Mississippi River Fuel Corp.), St. Louis.
Project: 115 miles of 24-in. from near Oran in southeast Mo., north between Ste. Genevieve and Bonne Terre into vicinity of

PIPELINE CONSTRUCTION

Herculaneum and Pevely then into St. Louis Co.
Status: Planned.
Completion: Last half 1960.

• **Monterey Pipeline Co.,** Los Angeles, Calif.
Project: 26 miles of 8 and 14-in. from Lake Boeuf field, Lafourche Parish, Louisiana, to Gramercy.
Status: Under way.
Contractor: **Houston Contracting Co.**
Completion: Oct. 15, 1959.
Project: 11½ miles of 8-in. from Thibodaux, La., to junction at State Highway 20.
Status: Under way.
Contractor: **Houston Contracting Co.**
Completion: Oct. 15, 1959.

• **Mountain Fuel Supply Co.,** Salt Lake City.
Project: 24.4 miles of 20-in. loop from Yellow Creek, Wyo., to Coalville, Utah.
Contractor: **Hood Construction Co.,** Whittier, Calif.
Completion: Oct. 15, 1959.

• **Natural Gas Pipeline Co. of America,** Chicago.
Project: 29 miles of 12-in. lateral from Enville and Southwest Enville fields, Love County, Oklahoma.
Status: Planned.
Completion: Tentatively Dec. 31, 1959.
Project: 16 miles of 3, 4, and 6-in. gathering system laterals in Jack and Wise counties, Texas.
Status: Planned.
Completion: Dec. 31, 1959.

• **New York State Natural Gas Corp.,** Pittsburgh.
Project: 14.5 miles of 26-in. from Chatham Township to Lawrenceville, Pa.
Status: Planned.
Completion: 1959.

• **Niagara Mohawk Power Corp.,** Syracuse, N. Y.
Project: 104 miles of 12-in. from Watertown, N. Y., to Massena, N. Y.
Status: Pending FPC approval.
Contractor: **Fulghum Contracting Corp.,** Harrisburg, Pa.

• **Northern Illinois Gas Co.**
Project: 140 miles of 22-in. from Des Plaines to East Dubuque, Ill.
Status: Under way.
Contractor: **Contracting & Material Co.,** Evanston, Ill.

• **Northern Natural Gas Co.,** Omaha, Neb.
Project: 217 miles of main line, 221 miles of main-line loops, and 2,178 miles of branch lines of various diameters.
Status: Approved by FPC.
Completion: 1959-60.
Contractors: **R. H. Fulton & Co.,** Lubbock, Tex., has contract for 55 miles of 16-in. from North Branch to St. Cloud, Minn., and **Williams Brothers Co.,** Tulsa, has contract for 57 miles of 10 and 12-in. from Brainerd to St. Cloud, Minn.
Project: 72 miles of 24-in. and 98.8 miles of 20-in. in Minnesota.
Contractors: **R. H. Fulton & Co.,** Lubbock, Tex., and **Williams Brothers,** Tulsa.
Project: 103 miles of 30-in. loop lines in Iowa, Nebraska, and Kansas.
Status: Under way.
Contractor: **R. H. Fulton & Co.,** Lubbock, Tex.
Completion: October 27, 1959.
Project: 36.5 miles of 2 to 16-in. gathering lines at Otis gas field, Kansas, for underground storage, and 36.7 miles of 30-in. transmission line connecting Otis storage area to main line at Bushton, Kans.
Status: Pending FPC approval.
Project: 188 miles of 24-in. and 215 miles of 30-in. from Farmington, Minn., to International border.
Project: 8 miles of 30-in. main line loop north of Ventura, Iowa, and 22 miles of branch lines near Marshalltown and Griswold, Iowa.
Status: Approved by FPC.

• **Offshore Gathering Corp.,** Houston.
Project: 364 miles in Gulf of Mexico off La.; 60 miles of 24-in., 70 miles of 26-in., and 234 miles of 30-in. dual line.
Status: Pending FPC approval.

• **Ohio Fuel Gas Co.,** Columbus, Ohio.
Project: About 30 miles of 18 through 24-in. in various locations in Ohio.
Contractor: **Shamrock Construction Co.,** Lansing, Mich.

• **Oklahoma Natural Gas Co.,** Tulsa.
Project: 10½ miles of 8-in. in Grady County, Oklahoma.
Status: Under way.
Contractor: **Pipeline Service Co.,** Seminole, Okla.
Completion: Nov. 1, 1959.

• **Pacific Gas & Electric Co.,** San Francisco.
Project: 120 miles of 34-in. looping of Topock-Milpitas main line.
Status: Planned. Pending FPC approval.
Completion: 1960-61.
Project: 42 miles of 30-in. from Pittsburg to Irvington, Calif.
Status: Planned.
Completion: 11 miles in 1959; 31 miles in 1960.
Project: 296 miles of 36-in. from Klamath Falls, Ore., to Antioch, Calif.
Status: Pending Canadian export permit and FPC approval.
Completion: 1961.

• **Pacific Gas Transmission Co.** (Pacific Gas & Electric, San Francisco).
Project: 614 miles of 36-in. from Kingsgate, B. C., to California border near Klamath Falls, Ore.
Status: Pending approval of FPC and Canadian authorities to import gas. To start late 1959.

• **Pacific Lighting Gas Supply Co.,** Los Angeles.
Project: 116 miles of 34-in. from Needles to Newberry, Calif.
Status: Planned.
Completion: June 1, 1960.

• **Pacific Northwest Pipeline Corp.,** Salt Lake City.
Project: 17 miles of 30-in. loop of Spokane-Coeur d'Alene lateral.
Status: Pending FPC approval.
Completion: 1961.
Project: 59 miles of 16 and 20-in. lateral line from a point on main line near Vancouver, Wash., to Salem, Ore.
Status: Pending FPC approval.
Project: About 5½ miles of 3 and 4-in. gathering line at Piceance Creek, Colo.
Status: Planned.
Completion: Nov. 30, 1959.

• **Panhandle Eastern Pipe Line Co.,** Kansas City.
Project: 3 miles of 4-in. lateral line, and 30 miles of 4-in., 4 miles of 6-in., and 4 miles of 8-in., gathering line.
Contractor: **Hall Construction Co.**
Completion: Dec. 31, 1959.
Project: 22 miles of 4-in., 7 miles of 6-in., and 8 miles of 8-in. gathering lines.
Status: Planned.

• **Pennsylvania Gas Co.,** Warren, Pa.
Project: 23 miles of 10-in. in Erie Co., Pa., 15 miles of 8-in. in Warren and Chautauqua counties, Pa.; 30 miles of branch lines, and several small distribution lines.
Status: Approved.

• **Peoples Natural Gas Co.,** Pittsburgh.
Project: 30 miles of 20-in. from Bentleyville to Imperial, Pa.
Status: Under way.
Contractor: **Joyce Western Corp.,** Olean, New York.
Completion: Oct. 1, 1959.

• **Permian Basin Pipeline Co.,** Omaha, Neb.
Project: 83 miles of 16-in. from the Pioneer gathering line in Schleicher County, Tex., to Spraberry, Tex.
Status: Pending FPC approval.
Completion: Fall 1959.

• **Phillips Petroleum Co.,** Bartlesville, Okla.
Project: 37 miles of 3 to 8-in. gathering lines in Lea and Eddy counties, New Mexico.
Status: Under way.
Contractor: **Lasley Construction Co.,** Hobbs, N. M.
Completion: Dec. 1, 1959.

• **Piedmont Gas Co.,** Hickory, N. C.
Project: 78 miles of 2 to 8-in. extension off Transcontinental in N. C., to serve Gaston, Lincoln, Catawba, Caldwell, and Burke counties.
Status: Approved.

• **Pioneer Natural Gas Co.,** Amarillo, Tex.
Project: 21 miles of 12-in. from Sudan to Muleshoe, Tex.
Status: Pending FPC approval.
Project: 12 miles of 10-in. from Muleshoe, Tex., northward.
Status: Pending FPC approval.

• **Richfield Oil Corp.,** Los Angeles.
Project: 60 miles of 20-in. from Cuyama Valley to Ventura, Calif.
Status: Under way.
Contractor: **Alex Robertson Co.,** Paramount, Calif.
Completion: Fall 1959.

• **Rio Gas Gathering Co.,** San Antonio, Tex.
Project: 97 miles of 3 to 8-in. gathering line in Hidalgo County, Tex.
Status: Pending FPC approval.
Completion: 1959.

• **Shamrock Oil & Gas Corp.,** Amarillo, Tex.
Project: 49 miles of 20-in. from Dumas to Amarillo.
Status: Planned.
Completion: Early 1960.

• **Signal Oil & Gas Co.,** Los Angeles.
Project: Extension of gathering system from Tioga, N. D., to near the Canadian border in Burke Co.
Status: Proposed.

• **South Texas Natural Gas Gathering Co.** (Coastal States Gas Producing Co., Corpus Christi, Tex.)
Project: A 60-mile line from existing system to steam generating plant in Pearsall County, Tex.
Completion: January 1960.

• **Southern California Gas Co.,** Los Angeles.
Project: 106 miles of 36-in. and 11 miles of 34-in. from Newberry, Calif., to Placentia.
Status: Proposed.
Completion: January 1, 1961.
Project: 91 miles of 34-in. from Newberry, Calif., to Ivanpah Lake.
Status: Proposed.
Completion: January 1, 1962.
Project: 3 miles of 34-in. in Sullivan Canyon northerly from San Vicente Boulevard, Los Angeles.
Status: Under way.
Contractor: **Engineers Limited Pipeline Co.,** San Francisco, Calif.
Completion: December 1959.
Project: 10 miles of 34-in. from Western terminal to Burbank line.
Status: Proposed.
Completion: December 1961.

• **Southern Counties Gas Co.,** Los Angeles, Calif.
Project: 14 miles from Moreno to Perris, Riverside County, California.
Status: Under way.

PIPELINE CONSTRUCTION

Contractor: **Engineers Limited Pipeline Co.**
Completion: November 1, 1959.

• **Southern Natural Gas Co.**, Birmingham, Ala.
Project: 34 miles of 24-in. from Enterprise, Miss., to Elmore, Ala.
Status: Under way.
Contractor: **C. S. LeNoir Construction Co.**, Austin, Tex.
Completion: November 1, 1959.
Project: 10.5 miles of 24-in. from Enterprise, Miss., to Gwinville, Miss.
Status: Under way.
Contractor: **Oklahoma Contracting Co.**, Dallas, Tex.
Completion: November 1, 1959.
Project: 79 miles of 18-in. from Gwinville, Miss., to Cranfield, Miss.
Status: Under way.
Contractor: **Oklahoma Contracting Co.**, Dallas.
Completion: November 24, 1959.
Project: About 66 miles of 20-in. from Elmore, Ala., to Macon, Ga.
Status: Under way.
Contractor: **Harbert Construction Co.**, Birmingham.
Completion: November 1, 1959.
Project: 22 miles of 14-in. from Macon, Ga., to Atlanta.
Status: Under way.
Contractor: **Harbert Construction Co.**, Birmingham.
Completion: November 1, 1959.
Project: 79 miles of 16-in. from Macon, Ga., to Wrens, Ga.
Status: Under way.
Contractor: **Buchanan Contracting Co.**, Birmingham.
Completion: November 1, 1959.

• **Tennessee Gas Pipeline Co.**
Project: 70 miles of 30-in. from Portland, Tenn., to Glasgow, Ky.
Status: Under way.
Contractor: **Williams Brothers Co.**, Tulsa.
Completion: Fall 1959.
Project: 72 miles of 30-in. in Kentucky.
Status: Under way.
Contractor: **Western Pipe Line, Inc.**, Austin, Tex.
Completion: Fall 1959.
Project: About 30 miles of 30-in. in Kentucky and 28 miles of 26-in. in Kentucky and West Virginia.
Status: Under way.
Contractor: **H. C. Price Co.**, Bartlesville, Okla.
Completion: Fall 1959.
Project: 21 miles of 16-in. gathering line from Louisiana coast to Block 46 in the Vermilion area.
Status: Pending FPC approval.
Project: 2 miles of 12-in. gathering line from Block 66 to Block 64, East Cameron area, offshore Louisiana.
Status: Pending FPC approval.
Project: 158 miles of 36-in. gas loop at various points between Kinder, La., and Centerville, Tenn.
Status: Approved by FPC.
Project: 41 miles of 30-in. loop east of Hamburg, N. Y.
Status: Pending FPC approval.
Project: 25 miles of 30-in. loop near Kane, Pa.
Status: Pending FPC approval.

• **Tensas Gas Gathering Corp.**
Project: 37 miles of 2 to 8-in. from Rodney field, Miss., westerly to connect with Olin Gas Transmission Co., line in Tensas Parish, La.
Status: Approved.

• **Texas Eastern Transmission Corp.**, Shreveport, La.
Project: 22 miles of 14-in. from Rayne field, La., to Opelousas.
Status: Under way.
Project: 81 miles of 24-in. from Tamarack, Pa., to Perulack, Pa.
Status: Pending FPC approval.
Project: 40 miles of 36-in. from Lambertville, N. J., to Linden, N. J.
Status: Pending FPC approval.
Project: 23 miles of 20-in. from Eagle, Pa., to Chester Junction, Pa.
Status: Pending FPC approval.
Project: 4 miles of 30-in. from Linden, N. J., to Staten Island, N. J.
Status: Pending FPC approval.
Project: 65 miles of 30-in. from Perulack, Pa., to Lambertville, N. J.
Status: Pending FPC approval.

• **Texas Electric Service Co.**, Fort Worth, Tex.
Project: 290-mile 22 or 24-in. line from Old Ocean field, Brazoria County, Texas, to Fort Worth, and 70-mile 16-in. line from there to Graham, Tex.
Status: Planned.
Completion: Fall of 1960.

• **Texas Gas Transmission Corp.**, Owensboro, Ky.
Project: 72 miles of 30-in. line in Louisiana and Arkansas.
Status: Under way.
Contractor: **Houston Contracting Co.**
Completion: Nov. 1, 1959.
Project: About 164 miles of 30-in. in Kentucky, Tennessee, Louisiana, Arkansas, and Mississippi.
Status: Under way.
Contractor: **Western Pipe Line, Inc.**, Austin, Tex., has contract for 93 miles of this project.
Project: 81.7 miles of 26-in. in Kentucky, Indiana, and Ohio, and 6.9 miles of 12-in. near Dixie, Ky.
Status: Under way.
Contractor: **Western Pipe Line, Inc.**, Austin, has contract for the 26-in. line.
Project: 93 miles of supply lines in Louisiana and adjacent offshore areas.
Status: Under way.
Contractor: **Houston Contracting Co.** has contract for 32 miles of 12-in. from South Roanoke gas field to Grand Cheniere, La.

• **Texas Illinois Natural Gas Pipeline Co.**, Chicago.
Project: 371 miles of 30-in. loop of present system between Texas and Chicago.
Status: Pending FPC approval.
Completion: 1960.
Project: 10.6 miles of 8-in. line in Starr and Hidalgo counties, Texas.
Status: Pending FPC approval.

• **Transcontinental Gas Pipe Line Corp.**, Houston, Tex.
Project: 38 miles of 30-in. main line loop in various locations.
Status: Pending FPC approval.
Completion: 1959.
Project: 74 miles of 36-in. main line loop in various locations.
Status: Pending FPC approval.
Completion: 1959.
Project: 45 miles of 30-in. main line loop in various locations.
Status: Pending FPC approval.
Completion: 1960.
Project: 78 miles of 36-in. main line loop in various locations.
Status: Pending FPC approval.
Completion: 1960.
Project: 13 miles of 24-in. Louisiana purchase lateral.
Status: Temporary authorization.
Completion: 1959.
Project: 18 miles of 20-in. Pennsylvania and New Jersey loop.
Status: Temporary authorization.
Completion: 1959.
Project: 40 miles of 8 to 20-in. Louisiana purchase lateral.
Status: Pending FPC approval.
Completion: 1959.

• **Transwestern Pipe Line Co.** (Warren Petroleum, Monterey Oil Co., J. R. Butler), Houston.
Project: 635 miles of 24-in. from Perryton and Fort Stockton, Tex., to Roswell, N. M., and 670 miles of 30-in. from Roswell to Topock, Ariz.
Status: Approved conditionally by FPC.
Contractors: **H. C. Price Co.**, Bartlesville, Okla.; **Houston Contracting Co.**; and **R. H. Fulton & Co.**, Lubbock, Tex.

• **Trunkline Gas Co.**, Houston, Tex.
Project: 48 miles of 16-in. and 27 miles of 4 to 12-in. gathering line from Hitchcock to Katy, Tex.
Status: Under way.
Contractor: **H. H. Null, Inc.**
Completion: October 1959.
Project: 24.5 miles of 12-in. gathering line from Lowry, La., to Cameron Parish shoreline.
Status: Under way.
Contractor: **Sam Carline, Inc.**, Berwick, La.
Project: 42 miles of 24-in. loop from west of Moss Hill, Tex., to Silsbee, Tex.
Status: Under way.
Contractor: **Sharman, Allen, Gay & Taylor, Inc.**, Houston.
Project: 32 miles of 32-in., 5 miles of 16-in., and 6 miles of 4 and 6-in. line from Lowry, La., to Cow Island, La.
Status: Under way.
Contractor: **Western Pipe Line, Inc.**, Austin.
Completion: October 1959.
Project: 20 miles of 16-in. and 5 miles of 14-in. from Cow Island to Louisiana Block 26.
Status: Under way.
Contractor: **Sharman, Allen, Gay & Taylor, Inc.**, Houston.
Completion: October 1959.
Project: 53 miles of 30-in. loop from Pitkin, La., to Pollock, La.
Status: Under way.
Contractor: **Grayco Constructors, Inc.**, Austin, Tex.
Project: 61 miles of 30-in. loop from Pollock, La., to Riverton, La.
Status: Under way.
Contractor: **APV Co., Inc.**
Project: 118 miles of 30-in. loop from Kilbourne, La., to Ballentine, Miss.
Status: Under way.
Contractor: **Panama, Inc.**, Houston.
Completion: October 1959.
Project: 60 miles of 30-in. from Brownsville, Tenn., to Canadaville, Tenn., and from Bardwell, Ky., to Polk, Tenn.
Status: Under way.
Contractor: **Panama, Inc.**, Houston.
Project: 57 miles of 30-in. loop from Polk, Tenn., to Brownsville, Tenn.
Status: Under way.
Contractor: **C. S. LeNoir Construction Co.**, Austin.
Completion: October 1959.
Project: 112.5 miles of 30-in. from Marion, Ill., to Neoga, Ill.
Status: Under way.
Contractor: **Panama-Williams Corp.**, Houston.
Completion: October 1959.
Project: 62 miles of 26-in. extension from Bourbon, Ill., to Rossville, Ill.
Status: Under way.
Contractor: **Contracting & Material Co.**, Evanston, Ill.
Project: 137 miles of 26-in. extension from Rossville, Ill., to Vistula, Ind.
Status: Under way.
Contractor: **Engineers Limited Pipeline Co.**, San Francisco, Calif.

• **United Fuel Gas Co.**, Charleston, W. Va.
Project: About 5 miles of 16-in. transmission line near Huntington, W. Va.

PIPELINE CONSTRUCTION

Status: Approved by FPC.

• **United Gas Pipe Line Co.**, Shreveport, La.

Project: 14 miles of 12-in. to connect North Henderson field area, Rusk County, Texas.

Status: Planned.

Project: 20 miles of 16-in. lateral in Louisiana.

Status: Approved by FPC.

Project: 8.7 miles of 30-in. line paralleling part of existing line from Agua Dulce field, Texas, which will be submerged by flood-control program.

Status: Approved by FPC.

• **Valley Gas Transmission, Inc.** (Fish Engineering Corp.), Houston.

Project: 150 to 160 miles of 3 to 6-in. gathering lines to tap fields in Starr, Hidalgo, Brooks, and Jim Wells counties, Tex.

Status: Pending FPC approval.

Completion: 1959.

• **Western Slope Gas Co.**, Denver.

Project: 11 miles of 6-in. from transmission line north of Fruita, Colo., American Gilsonite Co. plant.

Status: Under way.

Contractors: **A. J. Curtis Construction Co.**, Casper, Wyo., and **Western Paving.**

Completion: September 30, 1959.

Project: About 3 miles of 4 and 6-in. gathreing line in Northwest Douglas Creek field.

Status: Under way.

Contractor: **W. C. Striegel.**

Completion: November 1, 1959.

Canadian Crude Oil Pipelines

• **Act Oils, Ltd.**

Project: A 450-mile line from the Peace River region of northern B. C. to tidewater at Kitimat, B. C.

Status: Pending British Columbia Government approval.

• **Bituminous Oil Pipeline Co.** (Royalite Oil Co., and Can-Amera Oilsands Development, Ltd.)

Project: A 250-mile line from Athabasca oil sands in northeastern Alta., to Edmonton.

Status: Proposed.

Completion: 1960.

• **Gibson Crude Oil Purchasing Co., Ltd.**, Calgary.

Project: 180-mile 8-in. line from Milligan Creek, B. C., to Grand Prairie, Alta.

Status: Permit sought from B. C. government.

• **Independent Pipe Line Co.** (Home Oil Co.), Calgary.

Project: 1,073 miles of 36-in. from Edmonton, Alta., to Superior, Wis.; 946 miles of 34-in. from Superior to Montreal, Que.; 72 miles of 16-in. and 74 miles of 10-in. feeder lines from Calgary to Bellshill Lake, Alta., on the 36-in. line.

Status: Proposed.

• **Mid-Continent Pipe Lines, Ltd.**, Edmonton, Alta.

Project: 1,500 miles of 30-in. from Edmonton to Chicago, via Sask., N. D., Minn., Wis., and Ill. U. S. section to be owned by International Oil Pipeline Corp., New York City.

Status: Pending Canadian Board of Transport Commission approval. **W. C. Gilman & Co.**, New York City, has made preliminary study.

• **Peace River Oil Pipe Line Co., Ltd.**, Calgary, Alta.

Project: 130-mile 12-in. line from Virginia Hills through Windfall to the main line linking with Trans Mountain Pipe Line in Alberta.

Status: Pending government approval.

Project: 8 miles of 6-in., 45 miles of 8-in., and 17 miles of 12-in. from its Fox Creek Pump Station to Windfall, Virginia Hills, and Swan Hills fields in Alta.

Status: Approved.

Project: 220-mile, 8-in. line from Milligan Creek field, B. C., to Dawson Creek, B. C., and Sturgeon Lake, Alta.

Status: Permit sought from B. C. government.

Completion: Nov. 1, 1959.

Pembina Pipe Line, Ltd., Drayton Valley, Alta.

Project: 40 miles of 3, 4, and 6-in. gathering line in Pembina field.

Contractor: **Mannix Co., Ltd.**

Completion: November 1959.

• **Producers Pipelines, Ltd.**, Regina, Sask.

Project: 25-mile 4-in. line to connect Parkman Mississippian pool in southeast Saskatchewan.

Status: Pending approval of Saskatchewan government.

• **Rangeland Pipe Line Co.**, Calgary.

Project: 111-mile line from Cessford field to Calgary.

Status: Pending approval of Alberta government.

• **Trans-Prairie Pipelines, Ltd.**, Edmonton, Alta.

Project: 6-8-in. line from Weyburn field to Regina and Moose Jaw, Sask.

Status: Proposed.

Canadian Products Pipelines

• **Foothills Products Pipe Line, Ltd.** (Pembina Pipe Line Co., Mannix Co., Ltd.), Calgary, Alta.

Project: Gathering system to connect Alta. gasoline plants to trunk line from Alta. to Pacific Coast.

Status: Proposed.

• **Hydrocarbons Pipeline Co., Winnipeg**, Man.

Project: 800 miles of 6, 8-in. LPG line from near Edmonton to Fort William, Ont.

Status: Has Parliament of Canada approval. Seeking approval of Federal Board of Transport Commissioners and the Alberta Petroleum and Natural Gas Conservation Board.

Contractor: **Dutton - Williams Brothers, Ltd.**, Calgary, and **A. D. Little Co.**, Boston, are consultants.

• **Pembina Pipe Line, Ltd.**, Edmonton, Alta.

Project: A 1,200-mile line to carry sulfur, LPG, and natural gasoline from Alta.'s gas fields to eastern Canada.

Status: Proposed.

Canadian Natural Gas Pipelines

• **Alberta Gas Trunk Line Co., Ltd.**, Calgary.

Project: 256 miles of 36-in., 75 miles of 30-in., 55 miles of 26-in., 199 miles of various diameter gathering lines, and 42 miles of 16-in. delivery lateral.

Status: Pending approval of Canadian and U. S. regulatory agencies. To start late 1959.

• **Alberta Natural Gas Co., Ltd.** (Pacific Gas & Electric Co., San Francisco, and **Westcoast Transmission**, Calgary).

Project: 108 miles of 36-in. across southeastern British Columbia to U. S. border near Kingsgate, B. C.

Status: Pending approval of Canadian and U. S. regulatory agencies. To start late 1959.

• **British Columbia Electric Co.**

Project: 35 miles of 30-in. from Huntington, B. C., to Vancouver.

Status: Planned.

Completion: 1960.

• **Cartier Gas Corp.** (St. Maurice Gas, Inc., and Consumers' Gas Co., Toronto).

Project: 170 miles from Montreal to Quebec City.

Status: Proposed.

• **Northern Natural Gas Co.**, Omaha.

Project: 73 miles of 20-in. from Savanna Creek to Pincher Creek, Alta.

Status: Planned.

Project: 32 miles of 24-in. from Pincher Creek to Mont. border to tie in with planned U. S. line on to Minneapolis.

Status: Planned.

• **Trans-Canada Pipe Lines, Ltd.**, Toronto.

Project: 500 miles of main-line loops.

Status: Planned.

Completion: Late 1962.

• **Union Gas Co. of Canada, Ltd.**, Chatham, Ont.

Project: 5 miles of 8-in. from Delhi to Port Maitland.

Completion: October 1959.

Project: 6 miles of 8-in. at St. Thomas.

Completion: October 1959.

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PIPE LINE SURVEYS

PIPELINE CONSTRUCTION

• **Van Tor Oil & Exploration Co.**, Vancouver, B. C.
Project: Line from B. C. mainland to Vancouver Island.
Status: Proposed.
Completion: 1960.

• **Westcoast Transmission Co., Ltd.**, Calgary.
Project: 22-mile extension to connect reserves to be developed in the Jedney and Bubbles area of the Peace River region, British, Columbia.
Status: Planned.
Project: (See Alberta Natural Gas Co., Ltd., for joint project).
Project: 250 miles of 30-in. from Taylor, B. C. to Fort Nelson, B. C.
Staus: Planned.

Foreign Crude Oil Pipelines

• **Arab Pipeline.**
Project: 1,250-mile 40-in. pipeline from the Persian Gulf to Mediterranean serving fields in Saudi Arabia, Kuwait, Iran, and Iraq.
Status: Proposed by Saudi Arabian Government as project of Arab countries.

• **Arabian American Oil Co.**, Dhahran, Saudi Arabia and N.Y.C.
Project: 63 miles of 30, 32-in. from Khursaniyah to Ras Tanura.
Status: Planned.
Contractor: Company personnel.
Completion: January 1, 1960.
Project: 18 miles of 34, 36-in. from Qatif to Ras Tanura.
Status: Planned.
Contractor: Company personnel.
Completion: July 1, 1962.
Project: 6 miles of 30-in. from Ras Tanura to Ras Tanura terminal; 4 miles of 14-in. from Buqqa to QA-2 pipeline.
Status: Planned.
Contractor: Company personnel.
Completion: October 1, 1960.

• **Assam Oil Co.**, Digboi, Lakhimpur District, Assam, India.
Project: 600 miles of 20-in. from Nahorkatiya field in Upper Assam to Barauni, India, to connect with Burmah Oil Co.'s proposed 250-mile line from Barauni to Calcutta.
Status: Planned.

• **Barnabos Group** (Italian interests).
Project: A line from Venice, Italy, to Innsbruck, Austria, which could then be extended to Munich, Germany.
Status: Planned.

• **Basrah Petroleum Co.**
Project: 65 miles of 30 and 32-in. from Zubair to Fao in southern Iraq.
Contractor: **Turriff-Burden, Ltd.**, Tulsa.
Completion: 1961.

• **Bolivia-Paraguay.**
Project: 500 miles of 6-in. from Southeast Bolivia to a proposed refinery on Paraguay River, and later to Asuncion.
Status: Planned.

• **British Petroleum, Ltd.**
Project: 60 miles of 18-in. across South Wales, from Milford Haven to the Llandarcy refinery.
Status: Under way.
Completion: Late 1959.

• **Burmah Oil Co., Ltd.**, Glasgow, Scotland.
Project: 250 miles of 20-in. from Barauni to Calcutta, India, extending Assam Oil Co.'s proposed line.
Status: Survey under way.

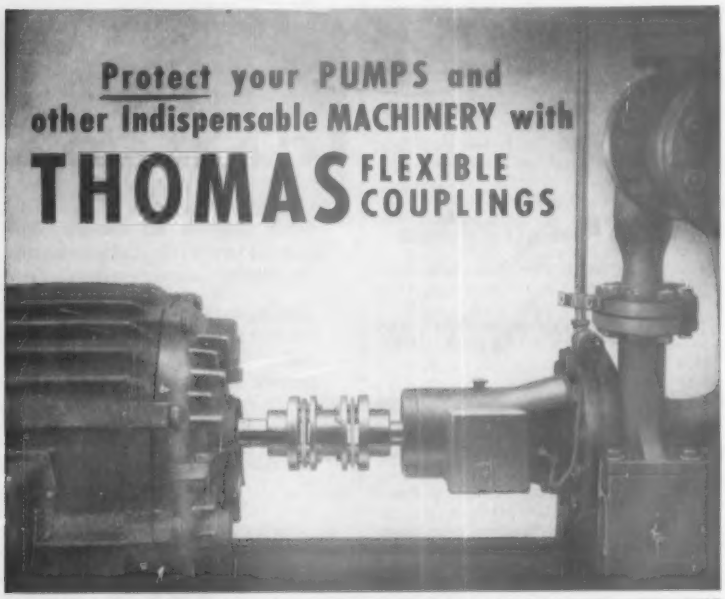
• **C.R.E.P.S., Societe Nationale de Recherche et d'Exploration des Petroles en Algerie (SN Repal) and Cie. Francaise des Petroles Algerie**, Paris, France.
Project: 470 miles of 24-in. from Edjele fields in southeastern Algeria to the Tunisian Mediterranean coast.
Status: Preliminary work under way.
Contractor: **TRAPSA** (transportation subsidiary of CREPS), with technical assistance and supervision of the project by **Bechtel Mediterranean** (subsidiary of Bechtel Corp., San Francisco).
Completion: September 1960.

• **Elburz Oil Corp.**
Project: 1,000 miles of 38-in. to move Qum crude to the Mediterranean.
Status: Planned.

• **ENI (Italian state oil agency)** and **Italo-Swiss Finance Co.**
Project: A 700-mile system from Genoa to Aigle, Switzerland, thence northeast to the German border, where it would split with one branch going to Munich and another branch to the Karlsruhe area. Feeder lines would go to Turin, Milan, and Cremona, Italy.
Status: The trunk line from Genoa to Aigle has been approved by the Italian Government.

• **Iranian Oil Participants, Ltd.**
Project: 30 miles of 20-in. and 22 miles of 16-in. looping of Agha Jari to Bandar Mashur line.
Status: Planned.
Project: 50 miles of 26, 28-in. from Gach Saran field to new terminal at Kharg Island in the Persian Gulf.
Status: Under way.
Contractor: A joint venture of **Raymond Concrete Pile Co.** and **Williams Bros. Co.**, Tulsa, **Richard Costain, Ltd.**, and **John Brown, Ltd.**, London, and **Werkspoor & Bredoro**, The Netherlands.

• **Iraq Petroleum Co.**, London.
Project: 250 miles of 30 and 32-in. in



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PIPELINE CONSTRUCTION

northern Iraq from Kirkuk to the Syrian border.

Contractor: **Turriff-Burden, Ltd.,** Tulsa.

Completion: 1961.

Project: 27 miles of 30-in. loop near T.2 station and 42 miles of 30 and 32-in. loop east of T.3.

Status: Under way.

Completion: 1959.

Project: 31 miles of 30-in. loop east of T.2 station and 25 miles of 30-in. between T.3 and T.4 stations.

Status: Planned.

Completion: Last half 1959.

- **Israel Government.**

Project: 16-in. loop of 8-in. line on 235-mile Gulf of Aqaba-Haifa system.

Status: Proposed.

Project: Replace 125 miles of 8-in. from Elath to Beersheba with 16-in.

Status: Under way.

Completion: Mid-1960.

- **Mene Grande Oil Co.,** Caracas, Venezuela.

Project: 24 miles of 16-in. from Zarra to Zulus; 12 miles of 24-in. from West Guara to Oficina; 5 miles of 24-in. near Melones.

Status: Planned.

Completion: 1959.

- **Middle East Pipeline.**

Project: 1,500 miles of 38, 40-in. from Persian Gulf to Mediterranean at Iskende run, Turkey.

- **Oil India Private, Ltd.,** Digboi, Assam, India.

Project: 30 miles of 12-in.; 230 miles of 16-in. and 460 miles of 14-in. from Nahorkatiya, Assam, to Barauni, Bihar.

Status: Planned.

Completion: April 1962.

- **Pan American International Oil Co.,** New York.

Project: 84-mile 12 to 14-in. line from Comodoro Rivadavia field to Argentina's Atlantic Coast.

Status: Under way.

- **Petroleo Brasileiro S. A. (Brazil).**

Project: 70 miles of 22-in. from Sao Sebastiao to Cubatao.

Status: Pending approval.

Contractor: **Techint, Inc.,** Milan, Italy.

Project: 80 miles of 24-in. to tie in to proposed Caxias refinery near Rio de Janeiro.

Status: Planned.

- **Rotterdam-Rhine Pipeline Co.** (Caltex Petroleum Maatschappij, Bataafsche Petroleum Maatschappij, Gelsenberg Benzin A. G., and Mobil A. G.)

Project: 59 miles of 30-in. and 96 miles of 24-in. from Rotterdam to Ruhr industrial area in West Germany to supply refineries at Godorf and Wesseling, and a 25-mile branch to Wessel to serve the refinery in Gelsenkuchen.

Status: Under way.

Contractor: **Bechtel International Co.,** is project manager. **Associated Pipe Line Contractors** has most of construction. German and Dutch firms have 33 miles of 24-in. in south Holland and four major submarine crossings.

Completion: **Mid-1960.**

- **Royal Dutch-Shell.**

Project: 700-mile line across Europe from the Mediterranean to the North Sea, running through eastern France, Luxembourg, West Germany, Netherlands, and Belgium. Main line to be 30-in.

Status: Considering project as joint venture with several other companies.

Project: 161 miles 20-in. line from Tandzung field to Balikpapan refinery, Borneo.

Status: Planned.

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PIPELINE CONSTRUCTION

Contractor: **Williams Brothers Overseas, Ltd., Tulsa, and John Brown, Ltd.,** London.
Completion: January 1, 1962.

- **South European Pipeline Co.** (Jersey Standard, Caltex, and 17 European firms).

Project: 419 mile 30-in. line from Lavera, near Marseille, to Strasbourg, with 40-mile extension to Karlsruhe, Germany.
Status: Awaiting official approval of French Government.
Completion: 1962.

- **Superior Oil Co.,** Los Angeles.

Project: A 16 and 24-in. line from its Lake Maracaibo, Venezuela, production to shore.
Status: Planned.
Contractor: **Pipe Line Technologists, C.A.,** Maracaibo, has design.

- **Syrian Pipeline,** Damascus.

Project: 500-mile line from Karshuk field, Syria, to Mediterranean.
Status: Proposed.

- **Union of Soviet Socialist Republic.**

Project: 2,315 miles of 28-in. Trans-Siberian crude-products line from Ufa Tuimaza fields in Bashkiria to Irkutsk near Lake Baikal.
Status: Under way.
Project: 600-mile line from Russian fields to Czechoslovakia.
Status: Planned for 1960.
Project: Line from Russian fields to East Germany, possibly as part of a petrochemical expansion program.
Status: Planned.
Project: 2,500-mile, 100,000-bbl. crude line from the Volga-Ural oil fields to the Soviet satellites in eastern Europe.
Status: Planned.
Completion: 1965.

- Yacimientos Petroliferos Fiscales (Argentina), Buenos Aires.

Project: 390 miles of 14-in from fields in Neuquen Province, Argentina, to Bahia Blancha on the coast.
Status: Bids requested.
Project: 625 miles of 12-in. from Mendoza to San Lorenzo.
Status: Planned.

- **Yacimientos Petroliferos Fiscales Bolivianos,** La. Paz.

Project: 407-mile 12-in. line from Camiri to Sica Sica.
Status: Planned.

Foreign Products Pipelines

- **Estrada Ferroviaria Santos a Jundial,** Sao Paulo, Brazil.

Project: 25 miles of 6-in. ethylene line from Cubatao to Rio Grande.
Status: Pending approval.
Contractor: **Techint, Inc.,** Milan, Italy.

- **National Iranian Oil Co.,** Teheran.

Project: 510 miles of 8-in. eastward from Teheran to Meshed, Iran.
Status: Planned.
Contractor: **Williams Brothers,** Tulsa, has contract for about half this project.

- **North Atlantic Treaty Organization** (Bid details from Bureau of Foreign Commerce, U. S. Department of Commerce, Washington).

Project: 57 miles of 8-in. in Germany to Land Baden-Wuerttemberg air field.
Status: Planned.
Project: 93 miles of 6-in. in Turkey.
Status: Bids requested in June 1959.

- **Petroleos Mexicanos**

Project: Line from Mexico City to Toluca.
Status: Planned.
Project: Line from Mexico City to Cuernavaca.
Status: Planned.
Project: Line from Monterrey to Torreon.
Status: Planned.

- **Pipelines of Puerto Rico,** San Juan.

Project: 95 mile 8-in. line from Commonwealth Oil refinery at Penuelas to Catano in the vicinity of San Juan.
Status: Approved by Puerto Rican Public Service Commission.

- **Union of Soviet Socialist Republic.**

Project: 2,315 miles of 28-in. Trans-Siberian crude-products line from Ufa Tuimaza fields in Bashkiria to Irkutsk near Lake Baikal.
Status: Under way.

- **Yacimientos Petroliferos Fiscales (Argentina),** Buenos Aires.

Project: 574 miles of 12-in. from Tucuman to San Lorenzo.
Status: Under way.
Contractor: **SARGO** subcontracted this project to **Techint, Inc.,** Milan, Italy.
Completion: February 1960.
Project: 652 miles of 10-in. from Lujan de Cuyo to Buenos Aires.
Status: Planned.

Foreign Natural Gas Pipelines

- **Attock Oil Co., Ltd.,** London.

Project: 60 miles of line from Dhulian field to Rawalpindi in West Pakistan.
Status: Planned.

- **Creole Petroleum Corp.,** Caracas.

Project: 17 miles of 30-in., 1.8 miles of 24-in., 1.7 miles of 20-in., and 1.6 miles of 16-in. from Lake Maracaibo flow stations to Conservation plant Bachaquero 1; 22 miles of 12-in. from Bachaquero 1 to Conservation plant Tia Juana 2.
Status: Planned.
Completion: June 1, 1960.

- **Cuban Gas Transmission Co.**

Project: 500-mile line from Campeche area of Mexico across Yucatan and a 150-mile line on the ocean floor to Havana.
Status: Under study by **Ebasco Services.**

- **French Government,** Paris.

Project: 400-mile big-inch gas line from Hassi R'Mel field to power plant at Bone, Algeria.
Status: Proposed.

- **Gaz de France.**

Project: 550 miles of 20 and 24-in. from Lacq field in southwestern France to Paris.
Status: Nearing completion.
Contractor: French contractors.

- **Indonesian Government.**

Project: 60-mile line from Radja field to proposed ammonia plant near Palembang, Sumatra.
Status: Planned.
Completion: Ammonia plant is scheduled for completion in 1962.

- **Kuwait Oil Co., Ltd.,** London.

Project: 10 miles of 12, 20, and 24-in. line in Burgan field.
Status: Under way.
Completion: Fourth quarter 1959.

- **Mene Grande Oil Co.,** Caracas, Venezuela.

Project: 20 miles of 12-in. from Soto to Mata.
Completion: 1959.

- **Petroleos Mexicanos,** Mexico D. F.

Project: 130 miles of 22-in. to parallel a 14-in. line from Reynosa to Monterrey.
Project: 490 miles of 24-in. from Jose Colomo field in the State of Tabasco to Mexico City.
Status: Under way.
Completion: March 1960.
Project: Line from Pemex City to Irapuato.
Status: Planned.
Completion: 1960.
Project: Line from Monterrey to Torreon.
Status: Under way.
Completion: 1960.

- **Standard-Vacuum Oil Co.,** New York.

Project: 60 miles of 8-in. in Sumatra terminating at Palembang.
Status: Planned.

- **Sui Gas Transmission Co.,** Multan, Punjab, India.

Project: 130-mile extension of the new 310-mile, 16-in. Multan-to-Sui, Pakistan line. Extension will terminate at Lyallpur.
Status: Planned.

- **Union of Soviet Socialist Republic.**

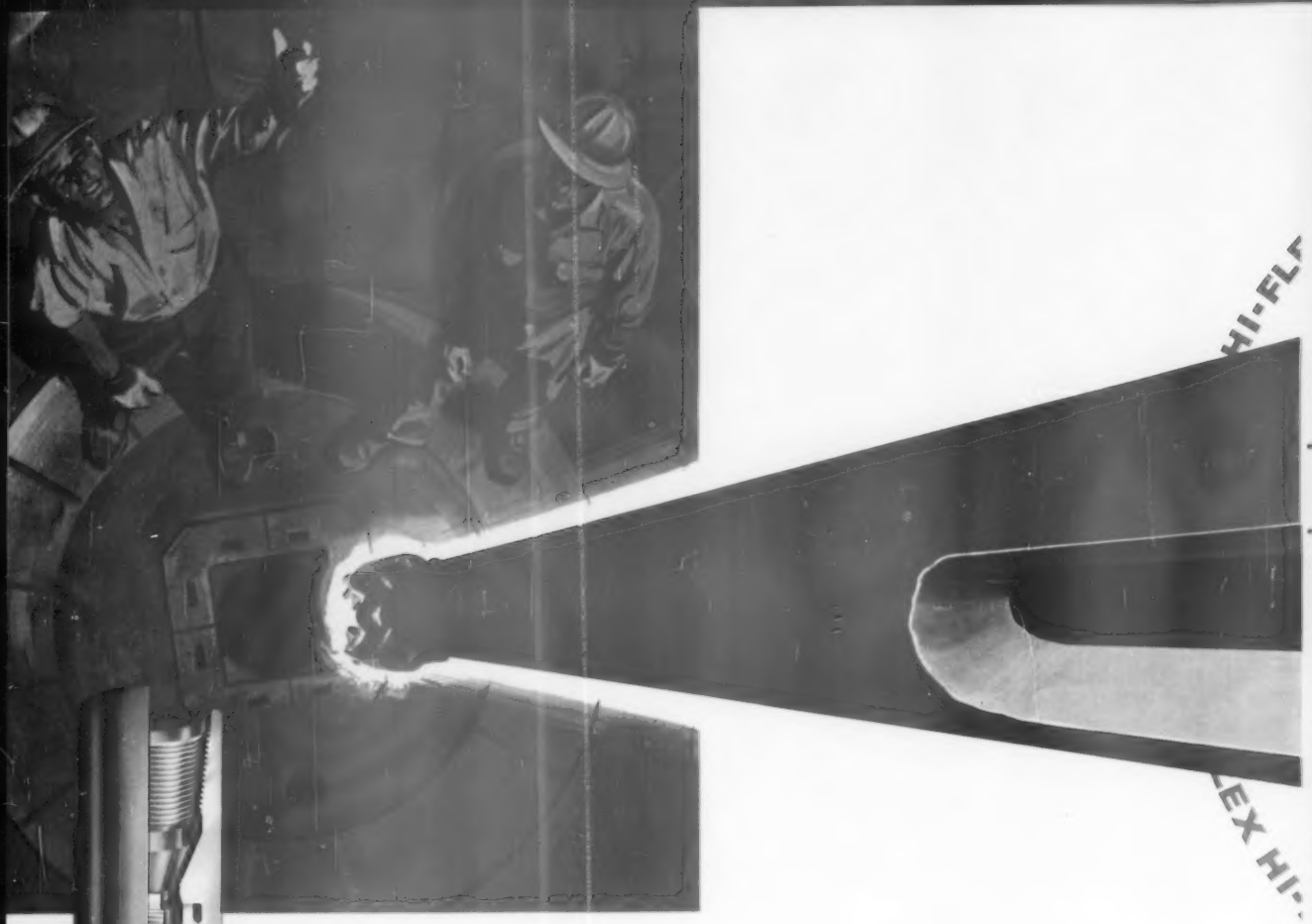
Project: A 465-mile line from Karadag near Baku to Tbilisi and Erevan.
Status: Under way.
Completion: 1960.
Project: A 127-mile line across the Turkmenian Desert from Kizyl-Kum to the Caspian Sea port of Krasnovodsk.
Status: Under way.
Project: Two parallel lines, each over 1,200 miles long, from Gazly, near Bukhara, northward to Sverdlovsk and Chelyabinsk.
Status: Proposed.
Project: Line from Samarkand, through Tashkent to Chimkent, Dzhambul, Frunze, and Alma-Ata near the border.
Completion: Line from Samarkand to Tashkent expected to be finished in 1960. Completion of rest of line expected in 1965.
Project: Line from Sverdlovsk to Omsk, Kemerovo and Tomsk.
Status: Proposed.
Project: Line from Berezovo field to Sverdlovsk.
Status: Proposed.
Project: Line from Stalingrad to Gorky and to Moscow.
Status: Proposed.
Project: Line from Dzhebol field to Izhevsk and to Sverdlovsk.
Status: Proposed.
Project: Line from Gorky to Kazan.
Status: Under way.
Project: Line from Saratov to Sverdlovsk, with branches into Stepanovskoe field.
Status: Proposed.
Project: Line from Kanevskoe (Kransnodar) field to Sulkhumi.
Status: Proposed.
Project: Line from Shebelinka field to Rostov, to Odessa, and northward to connect with proposed line from Lvov to Leningrad.
Status: Proposed.
Project: Line from Riga to proposed line from Lvov to Leningrad.
Status: Proposed.
Project: Line from Rostov to Moscow.
Status: Proposed.
Project: Line from Leningrad to Moscow.
Status: Under way.

- **Yacimientos Petroliferos Fiscales (Argentina),** Buenos Aires.

Project: 1,015 miles of 24-in. from Camp Duran to Buenos Aires.
Status: Under way.
Contractor: **SARGO** (Fish Engineering Corp., Fish Northwest Constructors, Inc., Clark Brothers, North American Utility Construction International Co.), subcontracted to COGAR (River Construction Corp., Ft. Worth, Tex.), Milton Brazier, supt. for 700 miles from Buenos Aires to Tucuman, office at Buenos Aires; E. L. "Tex" Maggard, supt. for 400 miles from Campo Duran to Tucuman.
Completion: August 1960.
Project: Line from Comodoro Rivadavia to Buenos Aires with a spur to Plaza Huincul field in Neuquen province. Line will be 26-in. to the connecting point for the Plaza Huincul link and 30-in. from the connection to Buenos Aires.

Visco

CONSISTENTLY EFFICIENT OIL FIELD CHEMICALS



The Reed HI-FLEX treatment prevents fatigue cracks and increases the life of drill collars. This treatment work hardens the surface of the steel. It places the skin of the metal under compression so that it can withstand the stress reversals that cause fatigue cracks. HI-FLEX is an exclusive REED process that gives better distribution of the stresses and better control of the stressed skin than any other known process.

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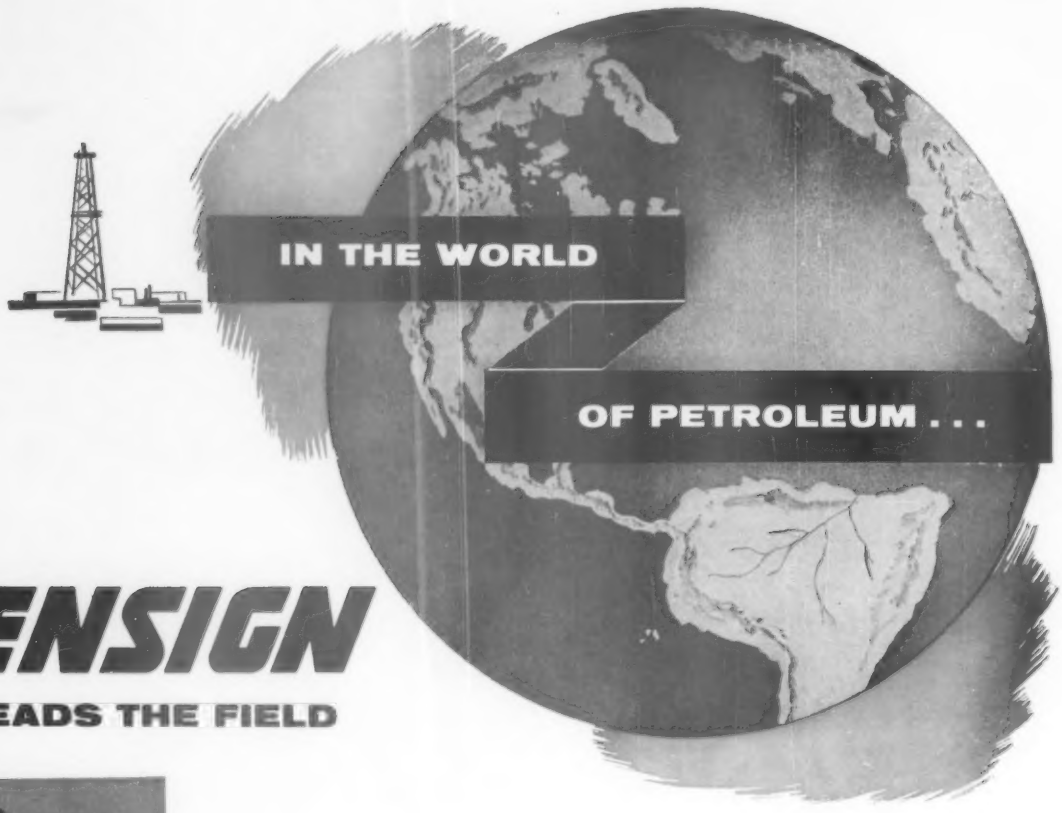


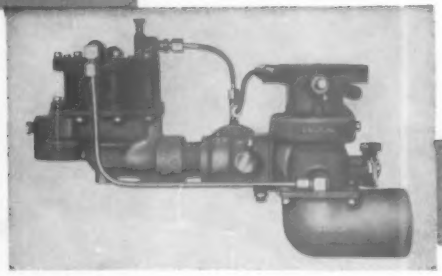
ENSIGN

LEADS THE FIELD

Gas Engine Carburetion

Gas engines operating in the remotest parts of the world, frequently in the hands of the most inexperienced, must be easy to start, easy to operate and easy to service. This calls for gas carburetion that is simple in design and rugged in construction. Toward this end ENSIGN engineers have concentrated their efforts and resources for nearly half a century. Results of this concentration of purpose are measured in terms of unparalleled gas engine performance. Proof of this comes in a quick glance at the gas engine market. Today hundreds of thousands of ENSIGN carburetors are in a 'round-the-clock operation throughout the world rendering indisputable evidence that engines equipped with ENSIGN can be depended upon to perform well under all conditions.

DEALERS AND DISTRIBUTORS IN ALL PRINCIPAL OIL FIELDS



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▶ ▶ ▶ New Equipment Section

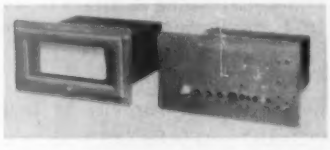
This week's SHOWCASE features . . .

Process computer control system

. . . just announced is to be built around a Beckman 123 data system and a selected commercial digital computer. With the new system, the manufacturer will be prepared to offer unified responsibility for applying computer control to a process or a complete plant. The 123 unit is an outgrowth of the 112 system which is currently in use by several oil companies and chemical firms. SOURCE: **Beckman Instruments, Inc., Dept. OGJ, 2500 Fullerton Road, Fullerton, Calif.**

Battery powers recorder circuit

. . . in this recorder just disclosed. The recorder operates only upon a change of incoming signal in either its analog or digital channels. It promises to be useful in monitoring either digital or sequential data or special forms of analog type of data. An



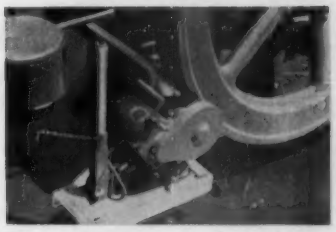
electrosensitive record, for instant viewing, is produced by self-contained transistorized sensing circuits powered from an internal, rechargeable, nickel-cadmium battery. The recorder and control unit together take up a space of only 17 by 17 by 17 in.

The recorder has six on-off channels and one digitized analog channel. The chart is 3¾ in. wide. The time at which an automatic record is taken is indicated electrically on the chart in binary form to the nearest minute. SOURCE: **Hathaway Instrument Div., Hamilton Watch Co. Dept., OGJ, 5800 East Jewell Avenue, Denver 22.**

●

Electric unit starts pump engines

. . . of the single-cylinder type, making engine-starting easier and faster than by hand. The Wichita portable



electric starting unit is designed so one unit can be used to start any number of engines equipped with a special mounting bracket.

The motor is powered from a 6 or 12-volt battery of a pickup truck and applied near the carburetor of the engine being started for easy adjustment while cranking. SOURCE: **Wichita Engineering Co., Dept. OGJ, 3315 Arthur Street, Wichita Falls, Tex.**

●

Expansion joint is easily repacked

. . . without taking the joint out of service. This most recent development in expansion joints, the Ram-Pak, is built with a lubricant-dispersion ring incorporated in it to provide complete and uniform lubrication of the plastic packing material. Only one

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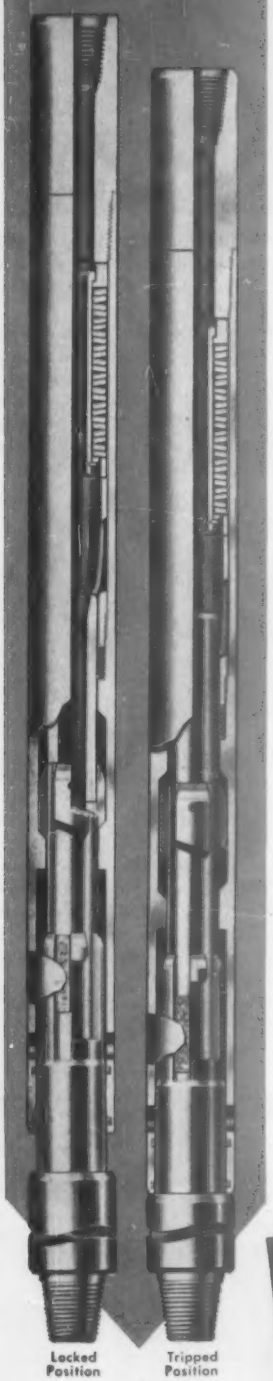
For running in the drill string . . .

Positive JAR-DOWN ACTION

. . . plus Safety Joint protection!



See the Shaffer section of your Composite Catalog.

THE SHAFFER-WAGGENER BUMPER SAFETY JOINT

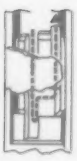
There is no other tool like the Shaffer-Waggener Bumper Safety Joint. It combines—in ONE tool—a choice of *jar-down* and *releasing* actions, both under complete control of the operator. What's more, the tool is so rugged it is run as part of the drill string to protect against stuck pipe.

In actual well service it has operated easily at depths below 18,000 feet, and has given no operating problems even in directionally-drilled wells with extreme slant.

Jar-Down Action

▶ **RUN IT IN THE DRILL STRING**—It is specifically designed to withstand the continuous vibration and heavy torque loads of today's drilling operations.

▶ **TO JAR DOWN** whenever the drill pipe threatens to stick—or to drive drill collars out of keyseats and to free "balled-up" bits—simply slack off weight equivalent to about 2,000 feet of drill pipe onto the tool. This releases the tripping mechanism, automatically striking a sharp down blow. Raising the string automatically re-sets the tool for another blow—and blows can be struck repeatedly as fast as the string can be raised and lowered. And no torque or twisting strains are placed in string!


Releasing Action

▶ **TO RELEASE,** in the event jarring will not loosen the stuck string, simply trip the tool and apply reverse torque as the string is slowly raised. Only one-sixth turn of the tool rotates the drive keys into unlocking slots so that complete release is effected by continuing to raise the string.

ANOTHER ADVANTAGE—the tool transmits full torque loads in *either* direction through three rugged drive keys—not through easily-damaged threads. It is the strongest joint in the string—not the weakest, as with conventional safety joints.

Also, the tool can be re-connected again by simply lowering the top portion over the lower portion and reversing the releasing action. It is ideal for use in fishing strings!

lubrication fitting is needed to lubricate the joint.

An internal guide acts as an inward and outward limit stop to prevent the slip from being pulled out of the joint body. A support base with four holes conforming to ASA standards is optional. SOURCE: **Adsco Div., Yuba Consolidated Industries, Inc., Dept. OGJ, 20 Milburn Street, Buffalo, N. Y.**

●

New tape for straight pipe sections

. . . now on the market, X-1102, has excellent tensile strength and tear resistance combined with balanced elongation, the maker says, to allow the tape to machine wrap smoothly at any taping angle. Stopping, starting, and jerking of a taping machine will not rupture the tape. The tape is a pressure-sensitive vinyl type with a high-tack adhesive, with extra internal strength to stop tape displacement caused by movement of soil or pipe.

The 10-mil tape has an elongation at break point of 250%, adhesion of 45 oz. per in. of width, tensile strength of 30 lb. in. of width, and an electrical strength of 13,000 volts. SOURCE: **Minnesota Mining & Mfg. Co., Dept. OGJ, 900 Bush Avenue, St. Paul 6.**

●

Drive group for rig or pump

. . . has been announced for engines supplying up to 300 hp. that is lightweight and available in two and three-section groups—Types B and BT-18-1¼Q. Drive can be mechanical or by torque converter. The drive groups are scaled-down versions of the maker's large B and BT series of drive groups. These groups are characterized by sectionalized construction, a master clutch with inertia type of brake, and a rollout type of clutch pump drive. SOURCE: **National Supply Co., Dept. OGJ, Two Gateway Center, Pittsburgh 22.**

One man can open hinged closure

. . . now on the market for scraper traps for pipelines, meter run inspection doors and meter provers, compressor-station blowdowns, scrubbers, vessels, tanks, heat exchangers, and similar piping.

A safety feature of the 8-in. and larger closures is that they cannot be opened if high pressure is present. SOURCE: **Tube Turns Div., Chemetron Corp., Dept. OGJ, 222 East Broadway, Louisville 1, Ky.**

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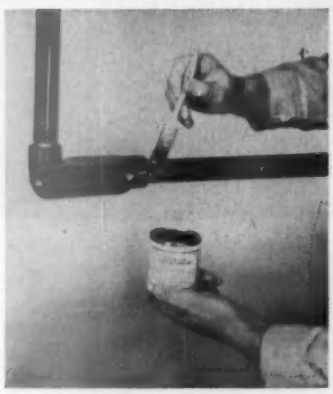


Plastic-coated electrical fitting

. . . has been put on the market for corrosive locations. It is unaffected by acid, alkalies, grease, or oil, the maker says. When properly installed with plastic or plastic-coated conduit, the Plast-A-Coat Condulet will last several times longer than conventional materials in most corrosive areas, the maker claims.

The coating resists abrasion and permits a complete plastic-covered metallic installation without losing the protection of ground continuity or impairing the safety of explosionproof apparatus. A touchup compound is available to cover exposed areas in threads and cover joints. SOURCE: **Crouse-Hinds Co., Dept. OGJ, Syracuse 1, N. Y.**

For fishing, testing and core-drilling strings . . .

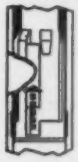
. . . plus Safety Joint protection!

Positive JAR-UP ACTION

THE SHAFFER OIL-SEALED JAR SAFETY JOINT

The Shaffer Oil-Sealed Jar Safety Joint is the only tool that combines a choice of *jar-up* and *releasing* actions, both under complete control of the operator at all times. What's more, all operating parts are sealed in a chamber filled with clean oil, fully protected against mud, sand and corrosive fluids.

The sealed-in-oil protection not only safeguards against abrasion and corrosion, and minimizes pressure differentials on packing elements, but also insures constant operating characteristics at all depths. This makes the tool ideal for fishing, testing and similar strings where light connections and equipment are used!



Jar-Up Action

▶ **JARRING ACTION IS AUTOMATIC**—simply raise the drill string until tension equals the pre-set tripping load, whereupon a sharp up blow is struck. Lowering the tool automatically re-sets the tripping mechanism for another blow—and repeated blows can be struck as fast as the string can be raised and lowered.

Releasing Action

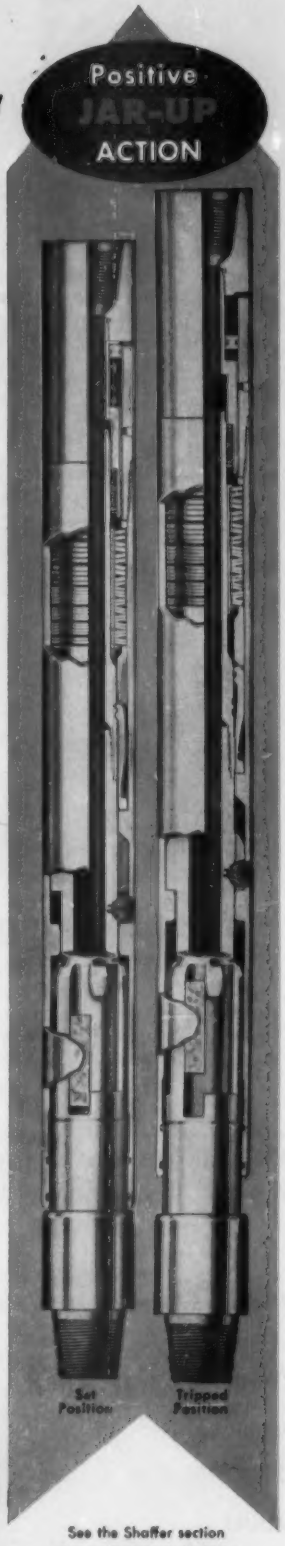
▶ **ONLY STRAIGHT PULL** is necessary to operate the tool—no torque or other secondary operations to affect the light connections commonly used in fishing, testing and coring strings.

▶ **TO RELEASE,** in the event the fish or stuck string cannot be loosened, simply trip the tool and apply reverse torque as the string is slowly lowered. Only one-sixth turn of the drive keys rotates them into an unlocking slot whereupon raising the string allows the parts to unlock.

AND NOTE THIS—not only does the tool transmit full torque loads in *either* direction, but no threads are used in the releasing mechanism. Therefore there's no risk of torque over-tightening the tool—nor can reverse rotation accidentally release it.

Also, force of the blow is absorbed by integral knocker heads—not by easily damaged drive keys or threads. The tool is designed for *sustained* jarring operations. And since it does not depend upon friction for its tripping action, the Jar Safety Joint always operates with the same pre-set action. Light strings are not subjected to unpredictable loads!

Free 8 page booklet gives many other facts about the Shaffer Oil-Sealed Jar Safety Joint. Write for it—or ask your nearest Shaffer representative.



See the Shaffer section of your Composite Catalog.

Machine lays cable fast

. . . and comes in two models. Both machines can be used to lay flexible cable or plastic pipe. Cable on a spool mounted on the frame is threaded through porcelain-lined rings and down through tubing on the rear. It is fed out about 4 ft. behind the subsoiler standard while still atop the ground to permit splicing. The standard is then lowered into the ground.

One model, the No. 1, is a direct-connected cable layer with a 20-in. depth. The No. 10 is a trailing type with a 24-in. depth for use with tractors having 50 to 80 draw-bar hp. Power-cable guides come in two sizes —1⅛ and 1¾ in. SOURCE: **International Harvester Co., Dept. OGJ, 180 North Michigan Avenue, Chicago 1.**

Blast recorder gives chart

. . . of vibration intensity and a meter indication. The new instrument, called Blastcorder, offers a way to help avoid costly delays and law suits. The records can provide an expert with valuable evidence with which to defend a blaster if litigation develops.

The instrument indicates or records the peak acceleration of ground or structural vibrations. It is self-contained, battery-powered, and protected by a glass fiber case measuring 6 by 12 by 19 in. Weight is about 20 lb. SOURCE: **Geotechnical Corp., Dept. OGJ, P. O. Box 28277, Dallas 28.**

●

Distillation unit permits fast test

. . . of refinery products. According to the maker, only 10 minutes are needed to make an automatic distillation test of products with the BP-Hone apparatus. Made under license from British Petroleum Co., Ltd., the apparatus is based on a rapid distillation method for routine testing of refinery products when the value of a single point on the distillation curve provides enough information for day-to-day volatility control. SOURCE: **Testing Machines, Inc., Dept. OGJ, 72 Jericho Turnpike, Mineola, N. Y.**

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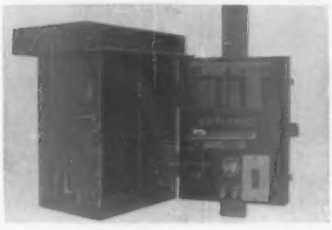

No adjusting needed for rectifier

. . . recently disclosed. The Amp-O-Matic amplifier for use in cathodic protection of well casings is designed to eliminate the need to adjust rectifier output when a hard rain or a dry spell change ground-bed resistance. The maker says simply set the rectifier for the amperage needed to give corrosion protection and forget it.

The rectifier has no moving parts, is extremely resistant to lightning damage, and cannot overload. It is made in voltage ratings of 110 to 220/440 with single-phase output. SOURCE: **Good-All Electric Mfg. Co., Dept. OGJ, Ogallala, Neb.**

Want more facts about equipment or copies of product literature described in this issue?

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Product name, Model no., literature title or number: .....

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GARRETT OILFIELD AUTOMATION

...IS THIS SIMPLE

Complicated electronics is fascinating in the laboratory but has no place on an oil lease. That is why Garrett, with years of oilfield know-how, developed a simplified and highly standardized system of automation for the entire well complex. Tested and proved in the field, Garrett equipment, which utilizes commercially available components, is now obtainable from off-the-shelf stocks.

Field units can be operated or restored to service by any pumper without specialized electrical training. The system uses standard 110 volt alternating current, with plug-in type replaceable elements.

Garrett automation covers every step of production control: wellhead flow, well test programming, LACT, recording, communications . . . plus home office reports and machine records.

Completely compatible with existing equipment and control systems, Garrett offers the additional advantage of building block design. You can start with the simplest well control system — then add further automation or expand as needs arise. When production justifies, the automation of the entire well complex can be completed without changing existing portions already automated.

Let a Garrett automation engineer consult with you on your next production automation program. He will explain how Garrett offers complete turn-key installations . . . call or write today.

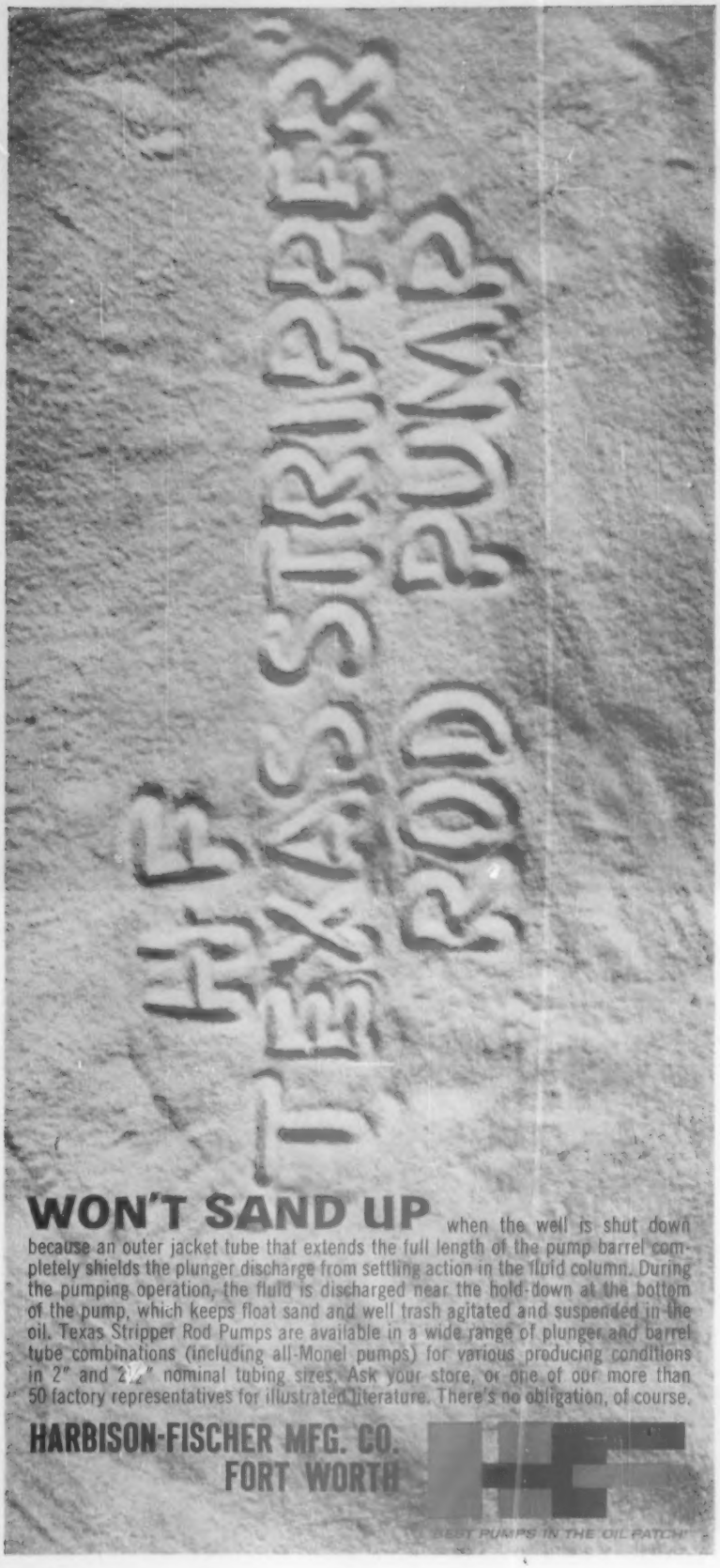
USI **Garrett Oil Tools**

DIV. OF U. S. INDUSTRIES, INC.

P. O. Box 2427, Longview, Texas

Garrett automation systems provide optimum production efficiency . . .

. . . from wellhead . . . to field station . . . to home office records unit.


H-F
TEXAS STRIPPER
ROD PUMP
WON'T SAND UP when the well is shut down because an outer jacket tube that extends the full length of the pump barrel completely shields the plunger discharge from settling action in the fluid column. During the pumping operation, the fluid is discharged near the hold-down at the bottom of the pump, which keeps float sand and well trash agitated and suspended in the oil. Texas Stripper Rod Pumps are available in a wide range of plunger and barrel tube combinations (including all-Monel pumps) for various producing conditions in 2" and 2½" nominal tubing sizes. Ask your store, or one of our more than 50 factory representatives for illustrated literature. There's no obligation, of course.
HARBISON-FISCHER MFG. CO.
FORT WORTH
BEST PUMPS IN THE OIL PATCH

SHOWCASE . . .

New Literature

Ever thought of writing a book?

. . . whether it be of the business, professional, or engineering variety, a new booklet should help you organize and develop ideas to the point where you can obtain the support and backing of a publisher. A new 50-page manual — Writing and Publishing Your Technical Book—answers questions about the author-publisher relationship, and presents checklists for preparing material for publication.

The literature includes information on the workings of business and technical publishers. It also features a point-by-point discussion of the author's contract, in which the responsibilities of all parties are outlined. SOURCE: **F. W. Dodge Corp., Dept. OGJ, 119 West Fortieth Street, New York City 18.**

Safe handling of sulfur dioxide

. . . is outlined in a new comprehensive technical publication. Designed for use as a reference guide, Bulletin I-173 includes sections on containers, unloading, care of equipment, leakage, and safety precautions.

In addition, it describes physical properties of liquid sulfur dioxide and contains a reference table of pressures of the chemical at given temperatures. SOURCE: **Inorganic Chemicals Div., Monsanto Chemical Co., Dept. OGJ, 800 North Lindbergh Boulevard, St. Louis 66.**

Coal-tar epoxy coatings

. . . are outlined in a new eight-page bulletin which contains compilation of 17 laboratory tests, showing what to expect when coal-tar epoxies are exposed to attack of various corrosive solutions and environments. Tests include salts, acids, caustics, bleach, petroleum products, distilled water, and weathering.

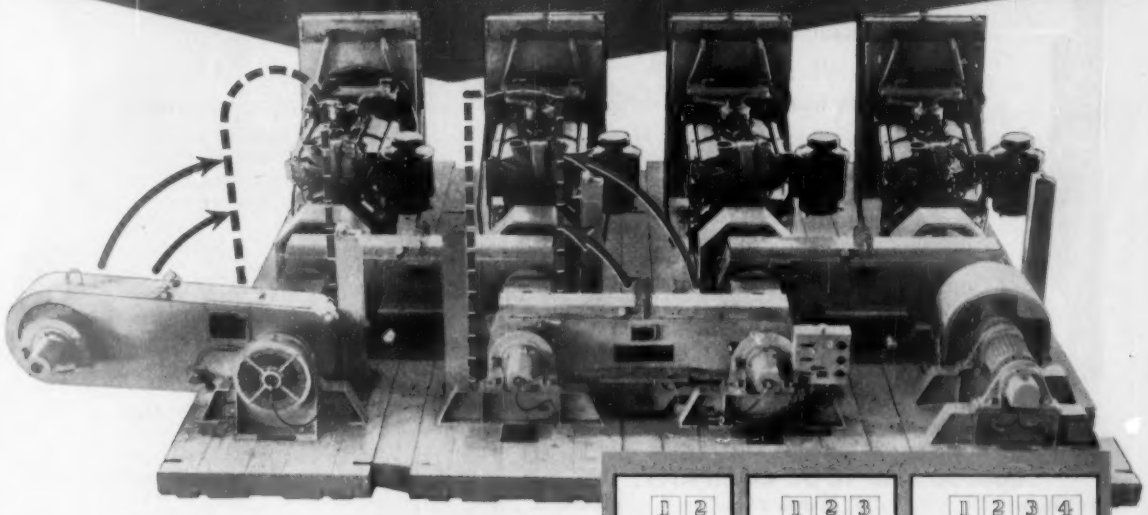
The publication illustrates and describes comparative performances of four leading coal-tar epoxies for each test. SOURCE: **Amercoat Corp., Dept. OGJ, 4809 Firestone Boulevard, South Gate, Calif.**

Slide rule, manual offered free.

. . . to interested parties upon request. The welded-metal bellows-design manual and the bellows-design slide rule should furnish you with most any

Swinging Compounds*

key to fast moves . . . quick rig-up!



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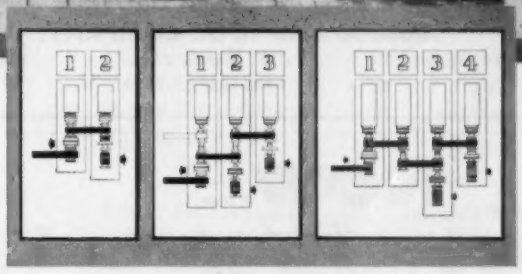

2AE 3AE 4AE

an exclusive feature on MID-CONTINENT AE RIG DRIVES

The Mid-Continent AE Rig Drive is a development of the Swinging Compound, a patented Mid-Continent feature. Swinging Compounds simplify the addition of engines, and makes possible moves without opening compound cases, draining oil, or "breaking" chains. Simply by pivoting Swinging Compounds to a vertical locked position, the units are ready to move to the next location. Designed for two, three, or four engines totaling 800 to 2400 horsepower, all compound case assemblies are identical for any combination. There is an AE Rig Drive to match your drilling requirements. Contact your Mid-Continent representative for complete information.

Scheduled for shipment to Argentina, this rig is equipped with a Mid-Continent 3AE Rig Drive including Swinging Final Drive, and Swinging Pump Drives for the maximum in flexibility and quick rig-up.

RD1-9

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Export Division: 45 Rockefeller Plaza, New York 20, N. Y. Cable: MIDCUMPORT NYK

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For a number of years MACCO has normalized all gas lift mandrels. These mandrels are heated to 1200-1400 degrees temperature for 4 hours. This stress-relieving process reduces concentrated corrosion and electrolysis to a minimum, thereby prolonging the useful life of the mandrel. NO EXTRA CHARGE is made for this service.

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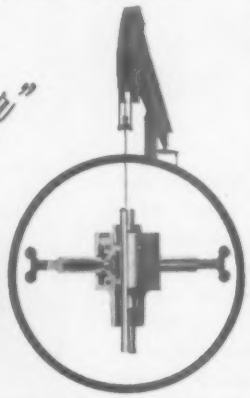
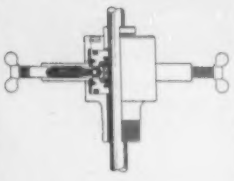
NOW...

"Maximum freedom from wear"

FOR EVERY PUMPING WELL

with **KINZBACH** "Type 241" Polished Rod Stuffing Box





Compensating for off-vertical movement of the polished rod, gland moves in same direction as rod, and maintains relative alignment with rod. Rod bears only against wear bushing at top of box.

Maximum freedom from wear of rod and tubing, and consequent longer life, is assured by the new, improved Kinzbach "Type 241" polished rod stuffing box with full-floating action.

Free to move laterally to compensate for any "off center" stroke of the rod, the floating gland is packed with a self-lubricated plastic packing. It may be tightened, and additional packing may be added at any time, without shutting down the well. Most wear is taken on the inexpensive, easily replaceable wear bushing.

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EXPORT: 74 TRINITY PLACE, NEW YORK, N. Y.

KINZBACH TOOL CO., INC.
P. O. Box 277 • HOUSTON, TEXAS

information you might need concerning bellows design.

The manual contains advanced mathematical formulas enabling you to compute reasonable design parameters for welded-metal bellows, for use as volumetric expansion devices, pressure sensors, rotary and linear seals, aneroids, stem seals, expansion joints, gimbal joints, etc. SOURCE: **Belfab Corp., Dept. OGJ, 910 Hobson Avenue, Handen, Conn.**

Petroleum Marketing—Yesterday and Today

. . . is the title of a 14-page booklet which provides an over-all view of the industry's products and typical channels through which they are marketed.

It includes a brief description of marketing techniques of yesteryear and contrasts them with present-day operations. The booklet was prepared as a means of answering general questions on marketing from students and teachers, as well as persons associated with the industry.

It contains capsule discussions on such topics as: the marketers; specialties and petrochemicals; and the consumer—the marketer's master. SOURCE: **Marketing Div., American Petroleum Institute, Dept. OGJ, 50 West Fiftieth Street, New York City 20.**

Proposed offshore-drilling platform

. . . which is designed to change locations in waters up to 300-ft. deep is shown in new four-page Bulletin 501-52 now available. It depicts some of the results of 3-years' research by marine engineers.

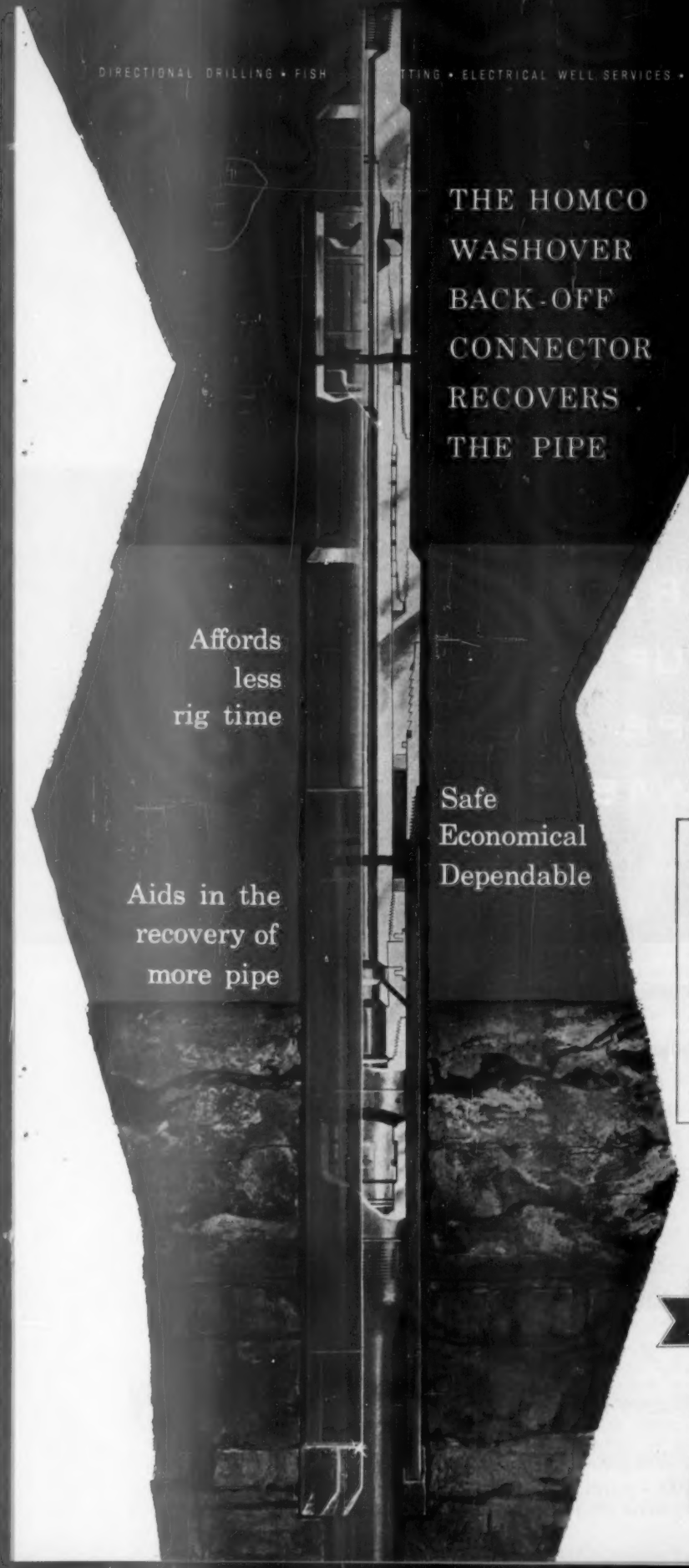
Ten illustrations show how slanted legs of the tripod platform will provide high stability. Also illustrated is the convenience in towing from one location to another, plus the relatively short time required for lowering legs and raising the deck. SOURCE: **R. G. LeTourneau, Inc., Dept. OGJ, 2399 South MacArthur, Longview, Tex.**

Corrosion-control Brochure AR-1

. . . contains information about an alloy bonding of zinc to steel that assures corrosion protection for plant window facilities without painting. The galvanizing protection is self-healing.

According to literature, pin holes and scratches in the window's surface are automatically filled by sacrificial action of the heavy zinc coating. SOURCE: **Fenestra, Inc., Dept. OGJ, 2250 Grand Boulevard, Detroit 11.**

DIRECTIONAL DRILLING • FISH[illegible]TTING • ELECTRICAL WELL SERVICES • OILFIELD SUPPLIES • EXPORT TOOLS & SERVICE



THE HOMCO WASHOVER BACK-OFF CONNECTOR RECOVERS THE PIPE

HOMCO
Fishing, Cutting and Electrical Well Service

Affords less rig time

Aids in the recovery of more pipe

Safe
Economical
Dependable

The HOMCO Washover Back-Off Connector is designed to safely increase the rate of recovery of stuck drill pipe or tubing in washover operations.

The basic function of the connector is to enable the operator to washover and back-off with the string shot, recovering the "fish" with one round trip of the drilling string, thus saving rig time.

On an actual fishing job, through the use of the HOMCO Washover Back-Off Connector and HOMCO String Shot, only seventeen trips were necessary to recover 9,188 feet of pipe. A total of 207 hours of rig time was used. Without the use of the HOMCO Washover Back-Off Connector and String Shot a total of 34 trips would have been required and 412 hours of rig time would have been used to accomplish the same job.

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WRITE FOR TECHNICAL BULLETIN NO. 27-1-1

NEW

MARK I CUP TYPE SWAB

Companion to the Proved E-Z Swab, the new Mark I Cup Swab uses the same mandrel but different rubbers. Mark I is a heavy duty positive displacement type swab able to lift a fluid load of from 1,200 feet to the heaviest loads encountered. Mark I was designed for use where the unique features of the E-Z Swab are not required. Heart of the Mark I—see cutaway—is a solid steel reinforcing core. This solid steel core can't wear, bend, and break as conventional reinforcing wires can. Can't hang up in tubing the way wires can. The new Mark I falls fast and comes out full. All this and the famous Mission Guarantee: "In a competitive test it will outperform all others or your money back." Order through your favorite supply store. Get your copy of the new brochure.

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59-309

Cardwell Mfg. Co. appoints

. . . James B. McDonough as equipment sales representative in the Gulf Coast area, reports G. T. Tucker, Cardwell's general sales manager.

McDonough's oil-field equipment background includes 2 years with United Supply in West Texas and 10 years with Continental Emsco. Six of those years were spent in export sales and service, during which time McDonough traveled throughout the Near East, Far East, and Australia.

Schlumberger shifts personnel

George C. Hepburn, Jr., has been named northeast division manager for Schlumberger Well Surveying Corp., with offices at Evansville, Ind., replacing W. J. Bowen. Bowen moves to Lafayette, La., to replace Frank H. Yeagers, newly promoted manager of the Mid-Continent area in Tulsa.

Yeagers takes the Tulsa post from Milton E. Loy, who has been transferred to New Orleans as manager of the southeast area. Loy replaces C. K. Ruddick in New Orleans. Ruddick has been moved to Houston as vice president in charge of operations.

G. C. Hepburn, Jr.

F. H. Yeagers

W. J. Bowen

M. E. Loy

Meanwhile, J. D. Cunningham, former sales engineer at Venice, La., has been promoted to location manager at Donaldsonville, La.

L. S. Kersey, formerly a field engineer at Lake Charles, has been promoted to sales engineer at Lafayette. J. E. Davis is now a sales engineer at Venice, La., and O. T. Maxwell is now serving in the same capacity at Kermit, Tex. R. H. Neustaedter is another newly named sales engineer at Tyler, Tex.

DOMESTIC SALES MEETING was held recently by Houston Oil Field Material Co., Inc. Attending the 2-day session in Houston were, from left, front row: Bob Duke, market research director; Warren Hollier, Rocky Mountain division manager; Don Burton, north-central division manager; Otho Meadows, assistant sales director; Z. C. Ambrose, executive vice president, domestic operations; A. W. Waddill, vice president, public relations; C. L. Roach, vice president, domestic operations, C. J. Erwin, West Texas-New Mexico division manager; R. M. Freeman, South Texas division manager; and L. H. Galeener, director of directional drilling. Back row, from left, are: Roger Eason, director of oil-field rentals; E. C. Alford, eastern Louisiana division manager; Gene Webb, western Louisiana-Mississippi division manager; T. C. Smith, director of fishing-cutting; H. H. Hughes, assistant director of fishing-cutting; Bob Dilworth, sales director; Howard Ward, California division manager; Frank Singletary, assistant director of directional drilling; and T. C. Burke, director of supply.

H. P. Boncher is named v.p.

. . . in charge of marketing of Dresser Industries, Inc. Until the present, Boncher was an operating vice president of Dresser. Boncher has been with the company since 1929.

Borror appointed sales engineer

. . . at Herb J. Hawthorne, Inc., announces W. A. (Bill) Davidson, sales manager of the Houston producer of exploration drill bits. John W. Borror's past experience includes associations with Gypsy Division of Gulf Oil Corp. and Sohio Petroleum Co.

Franks Division reorganizes

Ken Lamer

. . . the sales division for the West Texas-New Mexico area, according to Clyde M. Lackey, sales manager of Franks Division, Cabot Shops, Inc. Ken Lamer, newly appointed district manager of the area, will direct the new sales program from offices in Odessa, Tex.

Meanwhile, Jeff Gray, formerly at Farmington, will move to Odessa to serve the Permian basin. Hilmar Heinritz will continue as sales representative with headquarters at Odessa.

W. C. (Dub) Gray is appointed

W. C. Gray

. . . Gulf Coast division manager for Dallas-based rock-bit manufacturer, Security Engineering Division, one of the Dresser industries, announces Security's Sales Vice President Claude L. Griffin.

Prior to his appointment, Gray was Security's distributor sales coordinator, following several years as Oklahoma division manager. Before joining Security in 1945, he was with Halliburton Oil Well Cementing Co. Gray will locate in Houston.

Richard G. Keppler is appointed

. . . sales manager of refinery chemicals for American Cyanamid Co.'s Industrial Chemicals Division, announces G. W. Russell, division general manager. At the same time, Russell reported that B. H. Loper had become manager of refinery chemicals research for the division.

Keppler joined Cyanamid in 1953 as a senior technical representative with the refinery chemicals department. Since then he has had sales and administrative assignments in the Houston and Chicago offices. Most

recently Keppler was western regional manager of refinery chemicals with offices in Chicago.

Loper joined Cyanamid in 1950 at the company's Stamford laboratories, and since has served in a variety of manufacturing, sales, and research posts, primarily in refinery chemicals operations. Prior to this appointment, he was technical director of the refinery chemicals department in New York.

Thomas L. Moore becomes

T. L. Moore

. . . assistant sales manager of Tubesales, Los Angeles and New York distributors of steel tubular products. He formerly was with Republic Steel and Armco Steel.

In 1952 Moore joined Tubesales. He has served as sales representative in the Los Angeles area and as manager of technical services. He will now assist in the coordination of all outside and inside sales activities under the direction of H. P. Curtis, vice president, sales, and William C. Tagmyer, sales manager.

Bethlehem promotes Lee Fagg

. . . to assistant sales manager. Concurrently, Bethlehem Steel Co.'s Supply Division announced the promotion of L. C. Graves to sales manager, subsurface production equipment.

Lee Fagg

L. C. Graves

Both men will locate in Tulsa and will be under the direction of J. V. Spalding, general sales manager.

Fagg, a veteran of 31 years in the oil industry, began his career as a sales engineer with National Supply Co. His responsibilities now will be the promotion of sales for Bethlehem wire rope and all new and used rotary drilling equipment and accessories. Fagg will also be in charge of all export sales for both Bethlehem manufactured equipment and accessory materials.

Graves, another veteran of oil-field supply for over 30 years, joined Bethlehem in 1939 at Odessa, Tex. His new responsibilities will include the promotion of sales for sucker rods, Beeline subsurface pumps, and other related bottom-hole production equipment throughout areas where Bethlehem operates field stores.

Robert W. Blake is elected v.p.

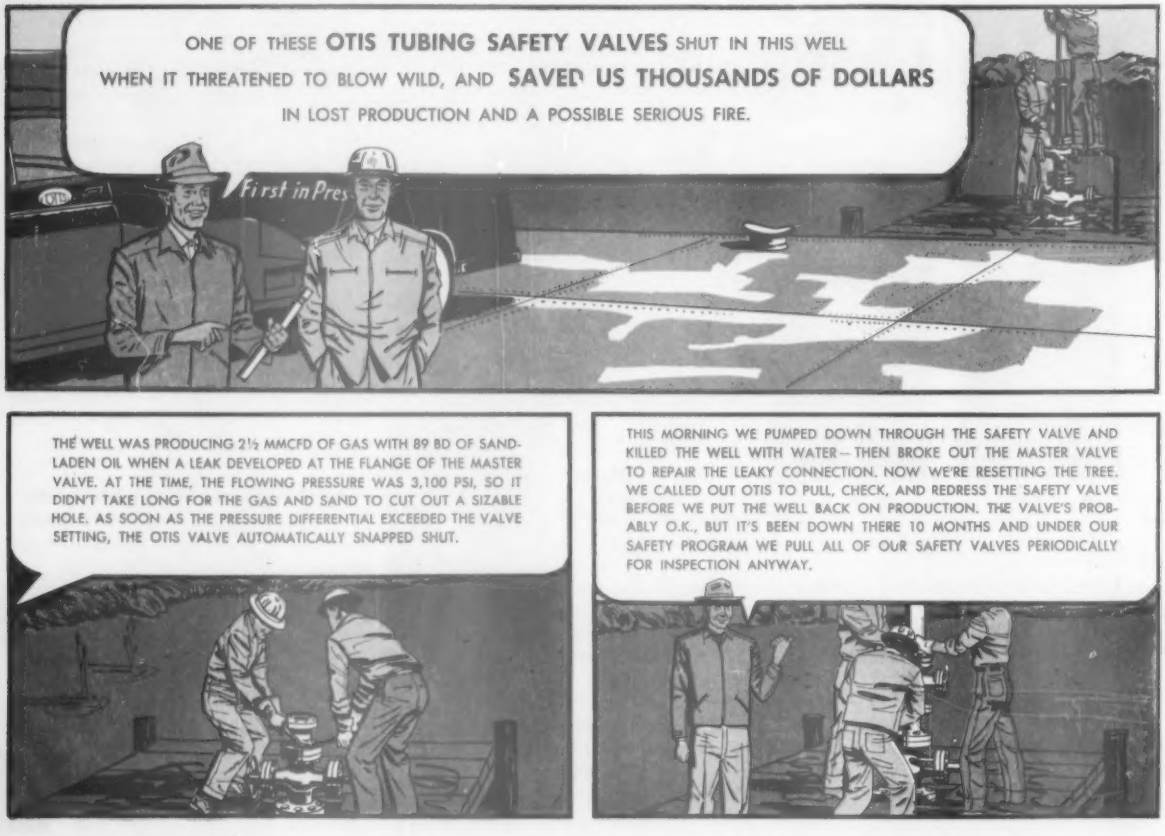
R. W. Blake

. . . in charge of sales of Shand & Jurs Co., according to R. C. Jurs, president. Succeeding E. E. Jurs who retired, Blake represented the Berkeley, Calif., firm in sales the past 22 years. Most recently he was regional vice president in charge of the company's eastern sales region activities.

William A. Zellars accepts

. . . the post of branch manager of Eggelhof Engineers, Inc.'s Tulsa office. He comes to Eggelhof from Callery Chemical Co., Muskogee, Okla.

Prior to joining Callery, Zellars was a project engineer for Texas Butadiene & Chemical Co., Houston, and was with Pan-American Petroleum Corp., from 1949 until 1956.


ONE OF THESE OTIS TUBING SAFETY VALVES SHUT IN THIS WELL
WHEN IT THREATENED TO BLOW WILD, AND SAVED US THOUSANDS OF DOLLARS
IN LOST PRODUCTION AND A POSSIBLE SERIOUS FIRE.
First in Pres
THE WELL WAS PRODUCING 2½ MMCFD OF GAS WITH 89 BD OF SAND-LADEN OIL WHEN A LEAK DEVELOPED AT THE FLANGE OF THE MASTER VALVE. AT THE TIME, THE FLOWING PRESSURE WAS 3,100 PSI, SO IT DIDN'T TAKE LONG FOR THE GAS AND SAND TO CUT OUT A SIZABLE HOLE. AS SOON AS THE PRESSURE DIFFERENTIAL EXCEEDED THE VALVE SETTING, THE OTIS VALVE AUTOMATICALLY SNAPPED SHUT.
THIS MORNING WE PUMPED DOWN THROUGH THE SAFETY VALVE AND KILLED THE WELL WITH WATER -- THEN BROKE OUT THE MASTER VALVE TO REPAIR THE LEAKY CONNECTION. NOW WE'RE RESETTING THE TREE. WE CALLED OUT OTIS TO PULL, CHECK, AND REDRESS THE SAFETY VALVE BEFORE WE PUT THE WELL BACK ON PRODUCTION. THE VALVE'S PROBABLY O.K., BUT IT'S BEEN DOWN THERE 10 MONTHS AND UNDER OUR SAFETY PROGRAM WE PULL ALL OF OUR SAFETY VALVES PERIODICALLY FOR INSPECTION ANYWAY.

Pipe Line Technologists names

R. S. Barfield

. . . Richard S. Barfield to the post of manager of European operations with offices in The Hague, The Netherlands. The firm opened this office a year ago under the direction of W. T. Pyott, executive vice president. As project manager for the Houston concern, Barfield recently completed an extensive gathering and truck-line crude-oil pipeline system in southwestern Kansas for Jayhawk Pipeline Corp. He also designed and placed in operation the Wheat Belt system in northwestern Oklahoma.

Prior to joining Pipe Line Technologists' staff in 1957, Barfield was with Gulf Refining Co.'s pipeline division in Houston for about 7 years. Before that, he worked for Alco Products, Inc., in Beaumont as a mechanical engineer.

Mid-States Chemical Co. names

. . . Peck Sales & Service Co. as a distributor for the Gulf Coast area. Peck's offices are in Houston.

Marvin Peck is president of the Houston distributor. Sales engineer is Bob Heinrich, and Milton O'Reilly is Peck's office manager.

Earl B. Cutter, Jr. is appointed

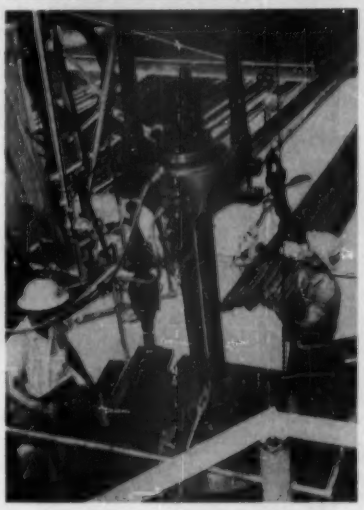
E. B. Cutter

. . . southern district manager of American Meter Co.'s southwest division, announces C. Benson Dushane, Jr., vice president in charge of sales. Cutter, who will make his headquarters in Dallas, had been assistant to the vice president, sales. He joined American Meter as a sales engineer in 1939.

Foster Wheeler Corp. reports

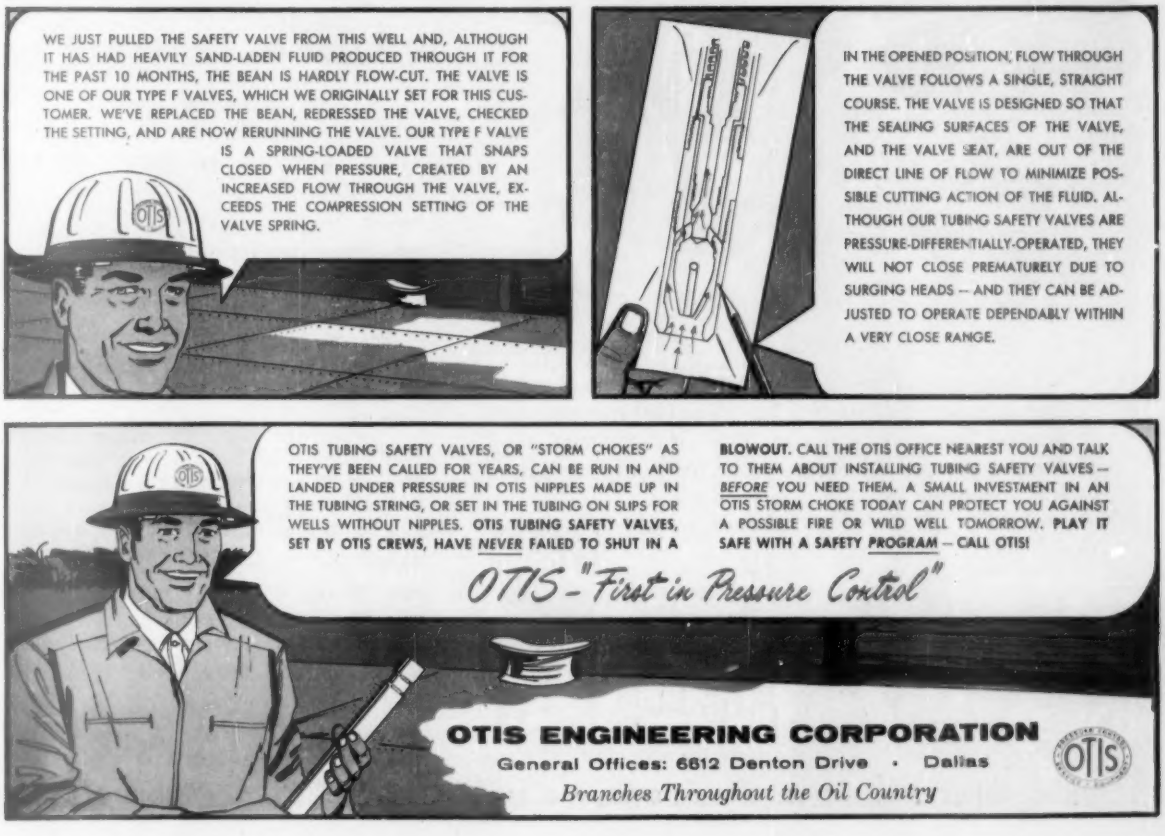
. . . three new appointments. C. P. Lattin, Jr., former vice president in charge of the Process Plants Division, assumes the job as general sales manager. B. L. Denker, previously manager of the contract operations department, becomes general manager of Process Plants Division.

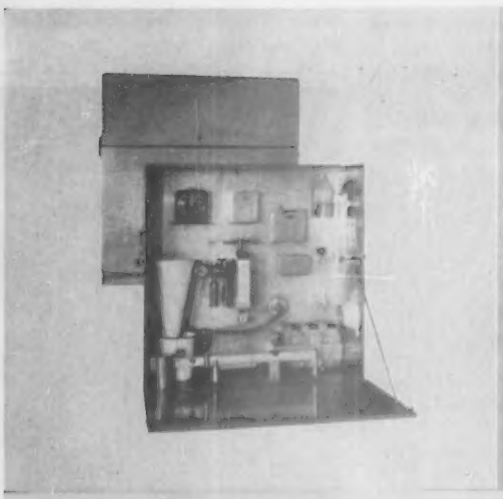
W. B. Hudson, manager of the proposal and process-engineering department, takes over as general manager of foreign operations. In this post Hudson will coordinate activities of Foster Wheeler's foreign subsidiaries and facilities.

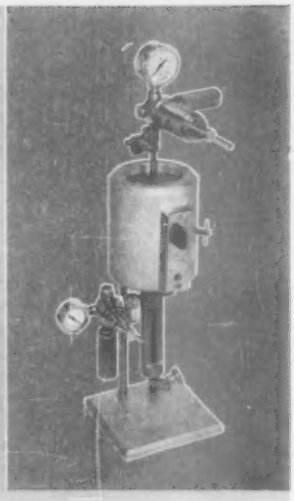


Four strings of tubing are run

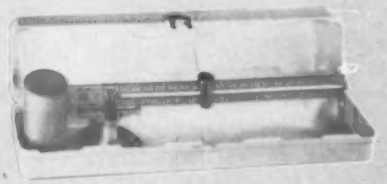
. . . at the same time with new multiple-string slips and elevators. Brown Oil Tools, Inc., reports that big savings in time is achieved when the company's multiple-tubing strings are run simultaneously. The elevators and slips are used for both completions and workovers.


WE JUST PULLED THE SAFETY VALVE FROM THIS WELL AND, ALTHOUGH IT HAS HAD HEAVILY SAND-LADEN FLUID PRODUCED THROUGH IT FOR THE PAST 10 MONTHS, THE BEAN IS HARDLY FLOW-CUT. THE VALVE IS ONE OF OUR TYPE F VALVES, WHICH WE ORIGINALLY SET FOR THIS CUSTOMER. WE'VE REPLACED THE BEAN, REDRESSED THE VALVE, CHECKED THE SETTING, AND ARE NOW RERUNNING THE VALVE. OUR TYPE F VALVE IS A SPRING-LOADED VALVE THAT SNAPS CLOSED WHEN PRESSURE, CREATED BY AN INCREASED FLOW THROUGH THE VALVE, EXCEEDS THE COMPRESSION SETTING OF THE VALVE SPRING.
IN THE OPENED POSITION, FLOW THROUGH THE VALVE FOLLOWS A SINGLE, STRAIGHT COURSE. THE VALVE IS DESIGNED SO THAT THE SEALING SURFACES OF THE VALVE, AND THE VALVE SEAT, ARE OUT OF THE DIRECT LINE OF FLOW TO MINIMIZE POSSIBLE CUTTING ACTION OF THE FLUID. ALTHOUGH OUR TUBING SAFETY VALVES ARE PRESSURE-DIFFERENTIALLY-OPERATED, THEY WILL NOT CLOSE PREMATURELY DUE TO SURGING HEADS -- AND THEY CAN BE ADJUSTED TO OPERATE DEPENDABLY WITHIN A VERY CLOSE RANGE.
OTIS TUBING SAFETY VALVES, OR "STORM CHOKES" AS THEY'VE BEEN CALLED FOR YEARS, CAN BE RUN IN AND LANDED UNDER PRESSURE IN OTIS NIPPLES MADE UP IN THE TUBING STRING, OR SET IN THE TUBING ON SLIPS FOR WELLS WITHOUT NIPPLES. OTIS TUBING SAFETY VALVES, SET BY OTIS CREWS, HAVE NEVER FAILED TO SHUT IN A BLOWOUT. CALL THE OTIS OFFICE NEAREST YOU AND TALK TO THEM ABOUT INSTALLING TUBING SAFETY VALVES -- BEFORE YOU NEED THEM. A SMALL INVESTMENT IN AN OTIS STORM CHOKE TODAY CAN PROTECT YOU AGAINST A POSSIBLE FIRE OR WILD WELL TOMORROW. PLAY IT SAFE WITH A SAFETY PROGRAM -- CALL OTIS!
OTIS - "First in Pressure Control"
OTIS ENGINEERING CORPORATION
General Offices: 6612 Denton Drive • Dallas
Branches Throughout the Oil Country





Now...All Baroid Mud Testing Equipment Available Through Your Baroid Store



lbs/gal	cp	°F	sec	pH
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ppm	% vol	cc	lbs/cu f	
lbs/gal	cp	°F	sec	pH
ppm	% vol	cc	lbs/cu f	
lbs/gal	cp	°F	sec	pH

All mud testing equipment in the complete Baroid line is now available quickly through your nearest Baroid Store, or you can order direct from any Baroid Service Engineer. Write for complete catalog and price list.

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▶ ▶ ▶ **Among the Drilling Contractors**

California companies have international flavor

TWO sister California drilling companies—Camay Drilling Co. and Camdrill International, Inc.—are truly garnished with international flavor, judging from the scope of their overseas operations. Both are headed by Tyler F. Woodward, Los Angeles-based president of the firms, who recently returned from visiting his crews in North Africa.

Algeria . . . Camay is operating as a coventurer with Compagnie Industrielle de Travaux in Algiers under the heading Citra-Camay. Citra is a large French public-works contracting firm (a Schneider enterprise). Camay has furnished the technical direction of this work. R. V. Towner, vice president of Camay, has been the company representative in Algiers and French Territories and has John Woodman as field superintendent for the Citra-Camay operations. The Citra-Camay coventure owns two Ideco Super 7-11 rigs and for the past 1½ years has been working in Hassi Messaoud field of Algeria for Compagnie Francaise des Petroles d'Algerie.

Drilling Conditions

Camay personnel had a new experience in oil-field operations working for, with, and under French supervision and technical administration. Citra-Camay commenced work with untrained French floor hands, but a very rapid development by the French personnel has greatly helped in the technical work performed. Hassi Messaoud field has changed from a barren desert to a highly developed camp and center of operations. Roads have sprung up everywhere. Hotels, shops, service centers, and many new buildings have been built to make the Hassi Messaoud camp one of the largest and best in any desert operating area. The French have performed a miracle in this region and have not stinted on the costs to obtain their objective.

Libya . . . Camdrill, Camay's sister company, has operated in the Mediterranean region for the past several years. It began its operations in the Sinai area of Egypt, and has worked as contractor in Sicily and North Africa. Camdrill is presently acting as contractor in Libya for five major American oil companies. This operation has grown from the initial drilling contract for Esso-Standard (Libya). Deep in the Fezzan area of Libya, it is some 500 air miles south of Tripoli in one of the worst desert regions known to man. One oil field was discovered during the first year of operations and several oil and gas shows were indicated. The sand trails to the drilling locations in the Fezzan area—where exploration drilling was done—total approximately 900 miles from Tripoli. Transportation of heavy material and supplies is extremely difficult and costly. Esso, however, maintained air service at all times to the camp. It transported personnel, as well as all of the fresh meats, vegetables, and foodstuffs, by air. All camp buildings are air-conditioned and the men soon get used to the desert.

Shipped Rig

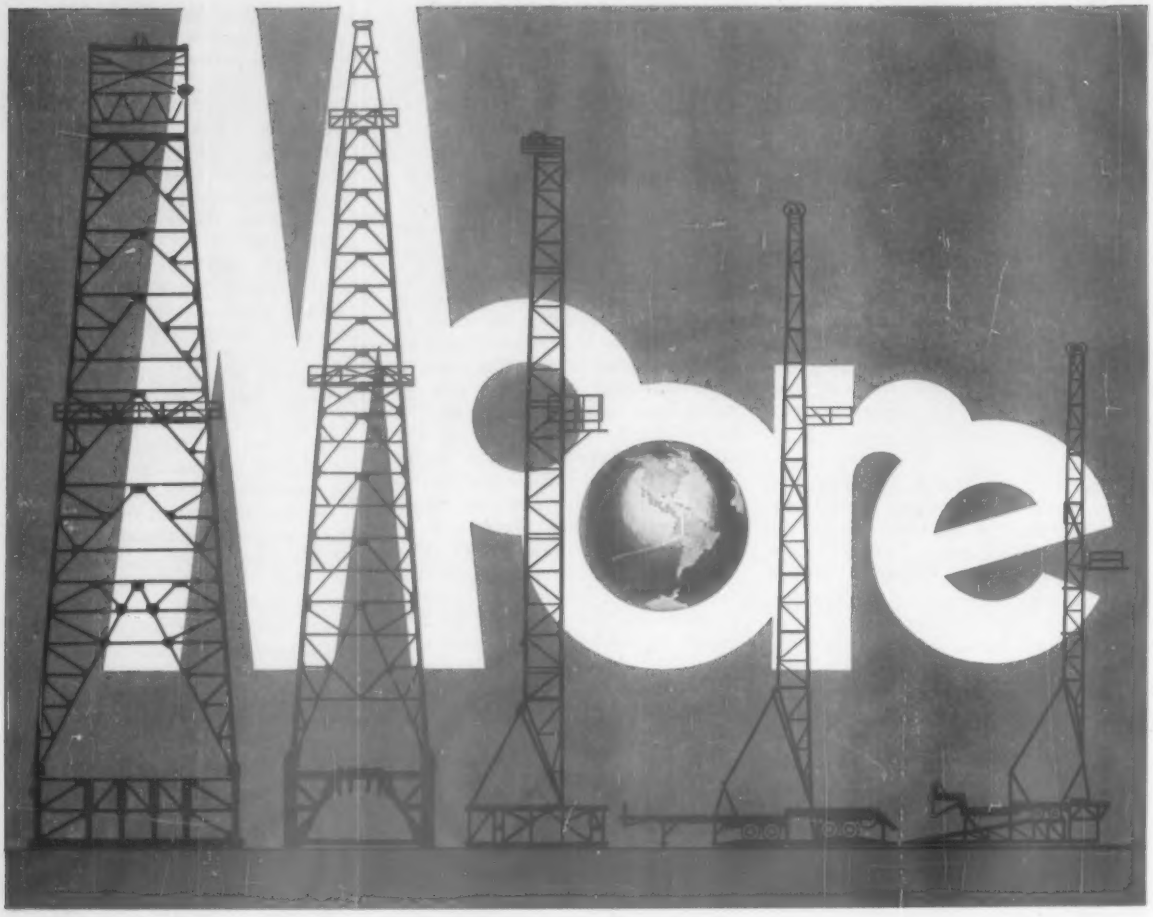
Soon after starting activities in Libya, Camdrill received a contract from Mobil Oil Co. of Canada, a subsidiary of Socony-Mobil Oil Co., Inc., and shipped to Libya a complete heavy-duty drilling rig. This rig was a combination of a National 110 draw works, and such integral parts as Ideco full-view mast, two Gardner-Denver GXR pumps, and other equipment. The most modern items of equipment available in the American market were selected and assembled. It was the first air-conditioned drilling rig ever sent to the Sahara Desert. This drilling equipment has been operating for Mobil Oil Co. of Canada for the past 2 years and has drilled all of the exploratory wells drilled by Mobil in Libya up to August 1, 1959. Camdrill is now operating a small Mobil-owned rig for water-well drilling and Mobil's desert rig. This rig, similar to Camdrill's Desert Star, is compact and highly unitized. Camdrill furnishes labor and supervision for these contracts.

Since beginning operations in Libya, Camdrill has developed the Desert Star, a highly mobile, compact, completely unitized desert-drilling rig. The first Desert Star was assembled in Beaumont, Tex., by Ideco, Inc., for Camdrill and included the latest in drilling tools. This rig was engineered and designed for high mobility and fast rigups and tearouts. It was delivered to the docks of Tripoli, Libya, the last week in December 1958, and was drilling deep in the desert 19 days later. It has performed flawlessly ever since.

On a recent move by Esso, the Desert Star was moved approximately 1,850 km. (about one-third the distance across the United States) across the pathless Sahara Desert from the western extremity of Libya, near the Algerian border, to the Zelten area 100 miles south of Benghazi. The Zelten area is now considered a proved oil field of great potential. The first two wells completed there by Esso were 17,500 and 15,000 bbl. per day, respectively. This oil is of light gravity and high quality. It is probably one of the most significant discoveries made in North Africa, and certainly the biggest potential producing area yet discovered in the Libyan Sahara.

Another Desert Star drilling unit is being completed by Camdrill for Oasis Oil Co. (jointly owned by Ohio Oil Co., Amerada Petroleum Corp., and Continental Oil Co.).

The Oasis Desert Star will be tested in Beaumont, Tex., and will arrive in Libya about the middle of October. This new rig will have the same mobility and compact unitization as the original Desert Star, but will have greater capacity.



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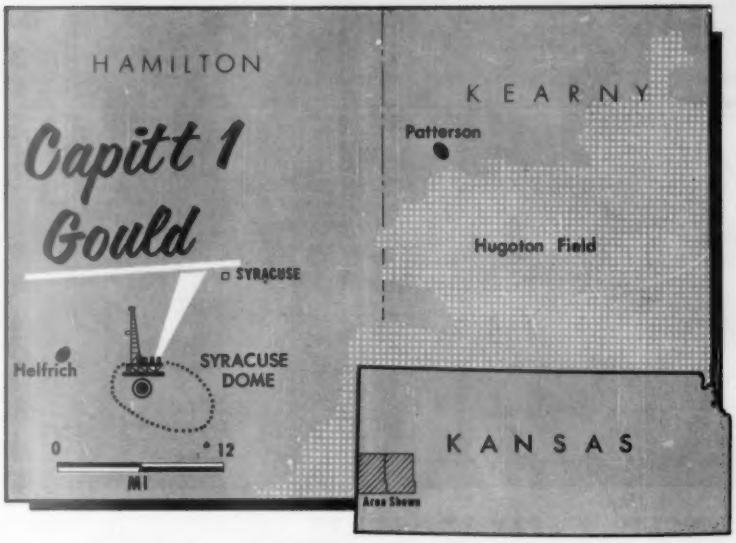


A DRY HOLE was drilled in western Kansas 22 years ago. Today, that dry hole is a producer, the Capitt Drilling Co. 1 Gould. Modern logging and new interpretation turned the trick.

The dry hole that *wasn't*

BY FRANK J. GARDNER

ON MAY 6, 1937, the Journal printed an exploration article under the byline of Dr. Ed Bloesch, prominent consulting geologist of Tulsa. The gist of it all was that the wildcatter would do well to heed the surface expressions of structure in the counties of western Kansas; that contours on the Dakota-Cretaceous sandstone at the surface would more than likely reflect structure in older rocks as well.

"While the Cretaceous rocks on which the structure has been worked rest unconformably on the Carboniferous and older rocks," Bloesch wrote, "any folding which has affected the surface rocks must have taken place in the underlying formations. Experience in the Mid-Continent indicates older strata have been more strongly folded than those at or near the surface."

A closed structure . . . Coming down to cases, Bloesch pointed to the Syracuse dome, a closed surface uplift lying 10 miles southwest of Syracuse in Hamilton County. Thirteen years earlier, in 1924, Wood Oil Co. had drilled a dry hole on the south flank of the dome in Section 5-26s-41w; with total depth 5,488 ft., it was the deepest well in Kansas or Oklahoma at that time. It had several shows of oil and gas on the way down.

Ed Bloesch believed that Wood had drilled off structure in a saddle. On the strength of his convictions, and on the basis of a USGS contour map of the Dakota surface, he recommended a new test at Syracuse, with location in Section 30-25s-41w. William J. Sherry, an independent operator, bought the idea, and contracted with Denver Producing & Refining Co. to drill the spot. It was a 6,000-ft. contract, aimed at the Simpson-Ordovician.

And an old dry hole . . . The well was dry. Sherry's 1 Porter went to a total depth of 6,453 ft. after topping the Simpson at 6,360 ft. At total depth, water intrusion and other difficulties forced abandonment.

Naturally, Geologist Bloesch was disappointed. All the requirements for an oil trap were there. The showings that were found in the Wood Oil Co. well were also present in the 1 Porter, updip from the Wood venture. But it was no go.

For 22 years, the Sherry 1 Porter showed on the maps as a dry hole. But today, it's shown as a producer. And Geologist Bloesch is a happier man.

Last May, Capitt Drilling Co. decided to reenter the old failure for a new look at the rocks under Syracuse dome. Now dubbed the 1 Gould, the old well was in good shape and the workover was simple. New methods of logging that were unknown in 1937 produced an electrical record entirely different from the one that was run in the original hole. Indications were favorable for oil in a section of the Morrow - Pennsylvanian at 5,120-28 and 5,132-34 ft. Tests were made on that horizon, and on June 10, 1959, the 1 Gould was completed for 70 bbl. of oil per day.

Reveal some lessons . . . Now a 70-bbl. oil well isn't likely to start a rush to western Kansas. But the lesson to be learned from this little story is double-barreled.

For operators, it's a living example of the undiscovered oil that's lurking in the company files.

For geologists, it's a sermon on the value of new methods of logging and interpretation and of the nearly lost art of surface geology. Many another western Kansas county, now dry, displays the surface signs of structure that led to the original drilling at Syracuse. And many a dry hole, ineptly logged and poorly tested, might be converted into a producer upon reexamination.

As "an important exploratory well," the Sherry 1 Porter rated half-inch headlines and a full-page story in 1937. Its successful completion 22 years later as Capitt 1 Gould went completely unnoticed. But to Geologist Bloesch, it was the climax to what will probably be the most memorable consulting job of his career.

The vindication, however, is not half as important to him as the demonstrated success of surface geology in western Kansas. He's a "hard-rock" man who still believes in the outcrop as a vital tool in exploration.

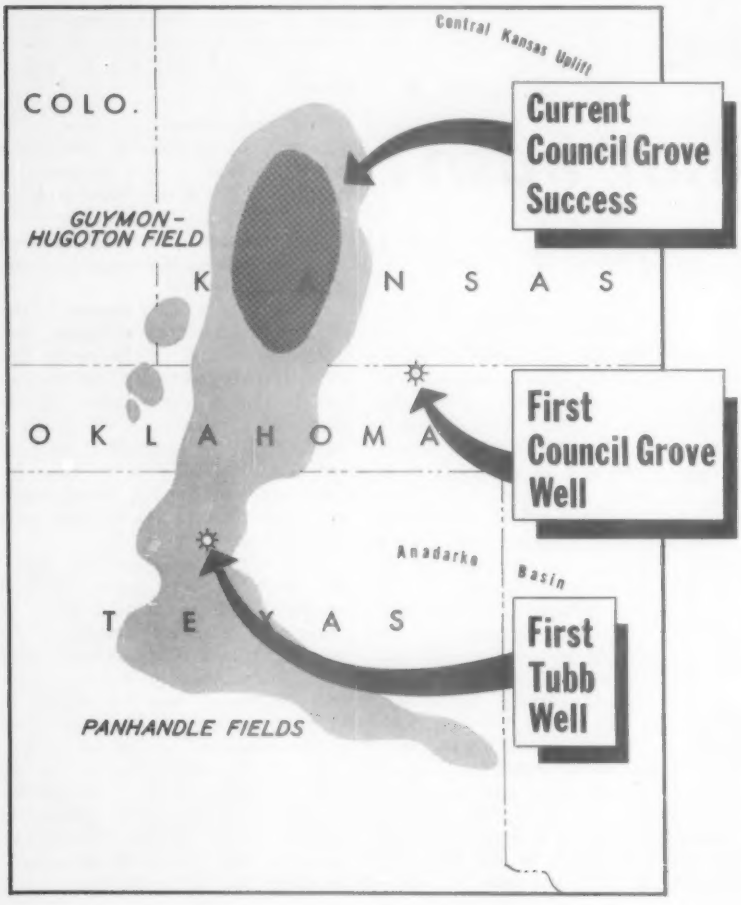
CORRELATION CHART: PANHANDLE AREA OF TEXAS AND OKLAHOMA

ERA	SYSTEM	SERIES	WESTERN ANADARKO BASIN GROUP	WESTERN ANADARKO BASIN FORMATION	PALO DURO AND DALHART BASINS GROUPS AND FORMATIONS ETC.	
PALEOZOIC	PERMIAN	OCHOA				
		GUADALUPE	WHITEHORSE	QUARTERMASTER	WHITEHORSE GROUP	ALIBATES
				ALIBATES DOLO.		
			NIPPEWALLA	SAN ANDRES GLORIETTA SS AT BASE	PEASE RIVER GROUP	SAN ANDRES
		LEONARD				GLORIETTA SAN ANGELO
				CLEAR FORK INCL. CIMARRON ANHY. AND TUBB ZONE	CLEAR FORK GROUP	CIMARRON ANHY.
						TUBB ZONE
			SUMNER	WICHITA PANHANDLE LIME	WICHITA GROUP	RED CAVE AT BASE
		WOLFCAMP	CHASE	HERINGTON OR BROWN DOLOMITE AT TOP	WOLFCAMP SERIES	BROWN DOLO.
			COUNCIL GROVE			COLEMAN JUNCTION
			ADMIRE			

Council Grove and Tubb sands are being tapped in what may be . . .

Another boom for the Panhandle

BY KENNETH CHASTEEN



THE WORLD'S largest continuous petroleum-producing area, a combination of Panhandle and Texas Hugoton fields of Texas, Guymon-Hugoton field of Oklahoma and Hugoton field of Kansas, may very likely be on the verge of still another boom.

Currently under the influence of one of the most extensive deep-drilling campaigns in history, operators in the three-state area are quietly beginning to take a look at a pair of Permian rocks, the Tubb sand and the Council Grove.

Long history . . . The huge Panhandle oil and gas field was discovered in 1918 by the Amarillo Oil Co. north of Amarillo on the Masterson Ranch. The discovery flowed 10 M.M.c.f.d. Shallow-well exploration spread to adjacent Carson County where, in 1921, Gulf Oil Corp. drilled the first oil well in the Texas Panhandle on the Burnett Ranch. About 2 years earlier, the great Hugoton gas field had been discovered at Defenders' Oil Co. 1 Boles in Seward County, although the event was little noted at the time.

Wildcatting continued sporadically through the years as the giant field took shape to eventually consist of producing wells in some 20 counties of the tri-state area. In recent years, drilling activity has continued at a brisk pace as operators developed inside acreage and tested the flanks. Each year sees a few new oil-produc-

ing areas opened in the Texas Panhandle portion.

New era begins . . . Recently, the Shamrock Oil & Gas Corp. of Amarillo drilled the 1 C. F. Brown as a Texas Hugoton field edge well 11 miles northeast of Sunray in Sherman County. Failing to find gas in the predominantly productive brown dolomite section, operators plugged back and perforated opposite the Red Cave or Tubb sand at 1,925-2,055 ft. After treatment, the well potentialed for 1 M.M.c.f.d. of gas with a rock pressure of 628.3 lb. Thus far, one attempt to confirm the discovery has failed while another is shut in awaiting orders.

Reaction to the discovery was not immediately noticeable; however, in the few months since, Amarillo operators, especially some of the major gas-producing and gathering systems, have had highly trained personnel silently at work.

Some are known to have approached the situation in the belief that the sand, which is known to prevail on over the Panhandle-Hugoton field area, grading into shale toward the Anadarko basin-Hugoton embayment region, may be generally productive. This is based on the fact that during the early stages of development in the field, operations were conducted for the most part with cable tools. The majority of the gas producers in the old field were completed from enormous open-hole sections. Operators simply drilled until the gas volume was too high to keep tools in the hole, then set pipe and moved to another location. Because of this, some are convinced that perhaps a portion of the gas is coming from the Tubb formation.

In the oil-producing areas of Panhandle field, the same drilling practices were used in many instances, leading these same people to believe that the high production of so-called casing-head gas from these wells may also be coming from the Tubb.

At least two companies have decided to see just what is going on. Natural Gas Pipeline Co. of America, operating from Amarillo, has staked a pair of geological wildcats to test the Tubb sand in Moore County. The firm's 102 J. T. Sneed, a 2,050-ft. venture, is 12 miles southeast of Dumas, while the 103 J. T. Sneed, a 1,940-ft. test, is 18 miles southeast of the same city. Both wells are well within the confines of gas production from the brown-dolomite and granite-wash producing sections of the old field.

" . . . Council Grove is causing operators to get cricks in their necks looking back up the hole after finding nothing in deep-zone exploratory tests."

Meanwhile, in southwestern Hutchinson County, inside of oil production in Panhandle field, H. F. Sears, another Amarillo operator, is currently nearing total depth of 2,000 ft. at 1-A Paramount, a Tubb sand prospect ½ mile west of Sanford. This prospect is some 30 miles south-southeast of the Shamrock discovery while the Natural Gas Pipeline ventures spot 20 to 25 miles southwest.

And in Kansas . . . Another Permian group, the Council Grove, is causing operators to get cricks in their necks looking back up the hole after finding nothing in deep-zone exploratory tests in Grant, Kearny, and Stevens counties, Kansas. These counties currently are experiencing a rash of Council Grove gas discoveries within old Hugoton field, and at least one company, Northern Natural Gas Producing Co., is embarking on a Council Grove drilling campaign.

Shell Oil Co., currently engaged in a 20-well deep exploratory campaign on acreage farmed out from Northern Natural in the three counties, has seen two of its deep failures taken over by that firm and completed as discoveries in the 5-10 M.M.c.f. range. Latest was the firm's 1-27 Broadhurst in 27-26s-37w, Kearny County. Dry for Shell at 5,490 ft. in the St. Louis, is was opened at 2,712-71 ft. by Northern Natural, acidized and fractured. Latest gage before being shut in for state test was 3,190 M.c.f.d. on a 6-hour blowdown.

This is only one of a dozen or more Council Grove discoveries finaled in the three counties since the first of 1959. Hugoton Production Co. of Garden City, Kans., has borne the bulk of exploration in Grant County, opening the pay at sites in 3-29s-37w, 19-29s-37w, 6-30s-37w, and 13-30s-27w. Northern Natural found the zone productive in 7-27s-37w.

In Stevens County, B. A. Hardy of Shreveport opened Council Grove gas production in 6-31s-37w, while Panhandle Eastern Pipeline Co. of Liberal, Kans. found it in 23-32s-39w and Hugoton Production Co. added it in 29-31s-37w and 23-31s-39w.

Recently, representatives of the two most active firms in the area, Northern Natural and Hugoton Production Co., expressed the belief that production from the Council Grove is fairly prevalent in perhaps the entire northern portion of the giant field or perhaps more, with the exception of pinchout and salt-water encroachment areas. Discoveries are continuing to crop up at 2 to 10-mile intervals in the three counties with at least half of them found on the way back up from deeper-zone failures.

As acreage in the area is held and will continue to be held by production from such zones as the Krider and Herrington in old Hugoton field, it is felt that at present most of the major producing and gathering companies in the area, who hold vast blocks of acreage, will hold the Council Grove in abeyance until it is needed by area gatherers; however, the increasing number of independent operators in the area should, over the next year or two, find conditions for farming out acreage favorable as the major acreage holders attempt to better define the Council Grove producing area with a minimum monetary outlay. The zone will spur deep exploratory work within the confines of the old field by offering the possibility of multiple production or a stopgap against total loss in the event of failure in the deeper formations.

The possibilities of these two Permian reservoirs are expected to add still more momentum to the interstate panhandle area activity. A new boom is in progress due to the tremendous deep zone exploration in the Anadarko basin and the Hugoton embayment. Liberal and Hugoton, Kans.; Woodward, Beaver City and Guymon, Okla.; Perryton, Tex.; and other small towns of a decade ago are currently centers of multimillion-dollar traffic in oil equipment, services, and supplies. Established oil centers such as Pampa and Borger, Tex., have added tremendous volumes of new business.

It remains for Amarillo to draw the lion's share of wealth generated by this boom. Headquarters for a large number of the companies operating in the tri-state area, it is fighting a running battle to keep up with the demands for office space by new firms entering the region—a total of over 20 thus far in 1959.

"Operators simply drilled until the gas volume was too high to keep tools in the hole, then set pipe and moved to another location."

FIG. 1

Anticlines like this, rising out of the desert, give clues to . . .

Oil structures of Oman

BY D. M. MORTON
Senior Geologist,
Iraq Petroleum Co., Ltd.

ARABIA, south of its known productive oil fields, has local traces of petroleum in outcrops of the Permian (Oman), the Jurassic (Hadhramaut), and the Cretaceous (Oman); and oil shows, so far noncommercial, have been found at several Paleozoic and Meozoic horizons in scattered wildcat wells in Oman. These do not yet provide any coherent picture of oil occurrence in the region, so this article is confined to a brief introductory account of their geological background in Oman.

The prospective territory is mainly desert, exposing flat-lying Tertiary to Recent deposits, where exploration by aerial and geophysical surveys and drilling supplements geological mapping. Deeper sections outcrop in the mountains of Oman, and along the south coast, where geological reconnaissances and some detailed local surveys have revealed the main features of the tectonics and a considerable amount of stratigraphic information. Intensive studies of microfacies have been applied to supplement paleontological correlations.

This is an abridgement of a paper presented at the Fifth World Petroleum Congress.

Regional Geology

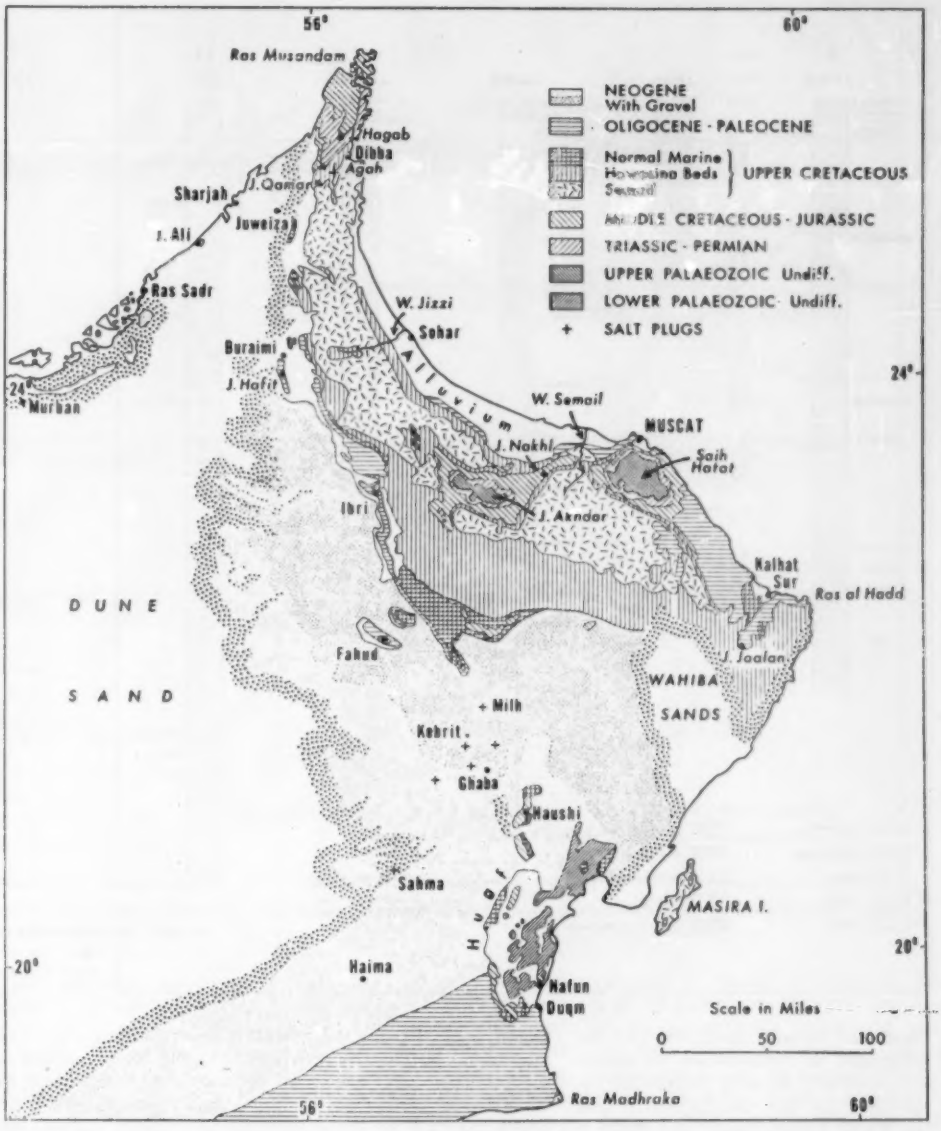
The territory of Oman is divisible into a mountain zone in the northeast and an almost featureless desert foreland to the southwest (Fig. 2).

The foreland is topographically and geologically a continuation of the gently-undulating shelf which expands eastwards from the Precambrian-Arabo-Nubian mass of Hedjaz. The mountain zone appears along the east coast as a detached orogenic arc with the over-all structure of a complex geanticline. It exposes rocks, including serpentines and radiolarites, which have counterparts in the mountain ranges of southwestern Iran (Zagros), and of landward Makran—"colored melanges."

Lees[1] suggested that the serpentinites ("Semail"), radiolarites ("Hawasina beds"), and underlying limestones ("Musandam," etc.), had been thrust individually on to the Aragian foreland by pre-Gosau nappe movements, from some geosynclinal zone to the east; but evidence will be given to show that these formations are autochthonous and that their chaotic structure is due to a region of "effusion tectonics" associated with Upper Cretaceous serpentinite extrusions on a great scale. The milieu of these extrusions can be studied to advantage in Oman because subsequent compression has had relatively slight and restricted effects, producing no well-defined thrust-zone or folded foredeep comparable with those of the Zagros range.

The regional relationships of the Oman orogen are still open to speculation.

It may be a quasi-independent eruptive unit; but most authorities assume that it has structural links with Iran. Thus, it has long been recognized that



GEOLOGICAL map of Oman shows mountain zone in northeast and barren desert foreland in the southwest. Fig. 2.

the north-south strike of its northern sector is in approximate alignment with an old structural trend through Central Iran and beyond; yet there is no reappearance of the Oman orogenic zones northwards in the Laristan Province of Iran across the Straits of Hormuz.

Lees regarded the range as a south-trending branch of the Zagros "nappe zone," deflected southwestward under the north northwest-south southeast late Tertiary folds of the Biaban Coast (although these show no effects of a discordant Upper Cretaceous substructure), and continuing southward to include isolated outcrops of serpentinite along the Batain Coast, at Maisra Island, and at Ras Madhraka.

However, those outcrops have no extensions to the north, where deep drilling (Fahud; Ghaba) and geophysical maps reveal normal foreland conditions.

Lees mentioned the possibility that the Oman orogenic zone might swing southwestwards off the Arabian Coast; but the coastal geology and bathymetric surveys off shore lend no support to this view, and the serpentinites themselves are now known to be alien elements in a foreland environment.

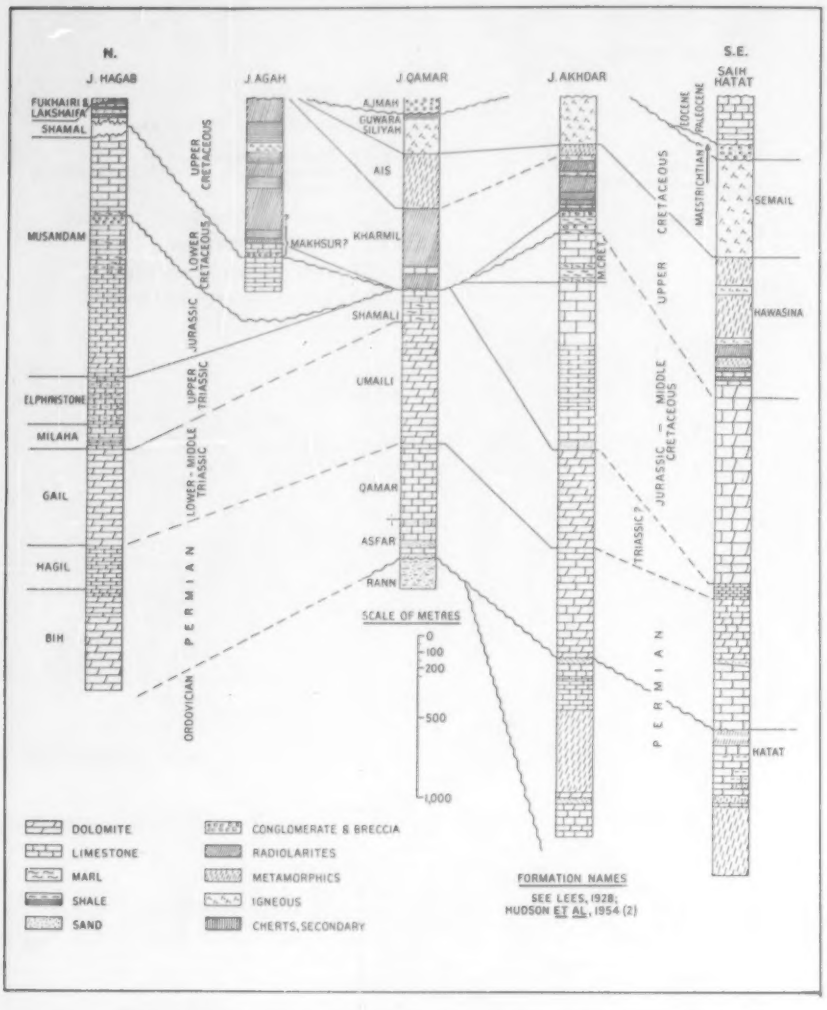
These observations are compatible with the results of air and ground reconnaissance which indicate that the Oman orogenic zone deflects wholly from a north-south strike in the north, to a northwest-southeast strike in the southern sector, where it is cut off rather abruptly by the Batain Coast, trending northeast-southwest.

Previous authors have associated this northeast-southwest coastal trend with large-scale normal faulting or wrenchfaulting. Both may have occurred, and transcurrent shearing along the "Masira fault zone" is invoked to account for the anomalous coastal outcrops of serpentinite.

In the north the range ends suddenly at its intersection with the Pirate Coast which also trends northeast-southwest; and the coastal belt is characterized by parallel normal and wrench faulting and by stratigraphic variations.

Parallelism of the Batain and Pirate coasts, and the conspicuous deflection of the Persian Gulf towards the Straits of Hormuz, may be coincidental; on the other hand it may be significant that their common trend is that of the "aualitic lineament" in the "rhegmatic shear pattern" (Sonder) of Africa and Arabia.

Wrench faulting along the Batain



STRATIGRAPHIC chart shows that the oldest exposed formations appear in a series of axial uplifts. Fig. 3.

coast may be associated with the development or rejuvenation of northeast-southwest shearing movements responsible for this pattern (part); and the Pirate Coast trend may have a similar explanation, though critical evidence is now concealed by later deposits.

Thus wrench faulting on a very large scale could account for detachment of the Oman orogenic zone from former connections to the north and south.

This speculation introduces considerations beyond the scope of this article, but is noted here as a possible alternative to other hypotheses concerning the regional relationships of the Oman orogenic zone.

Geological History

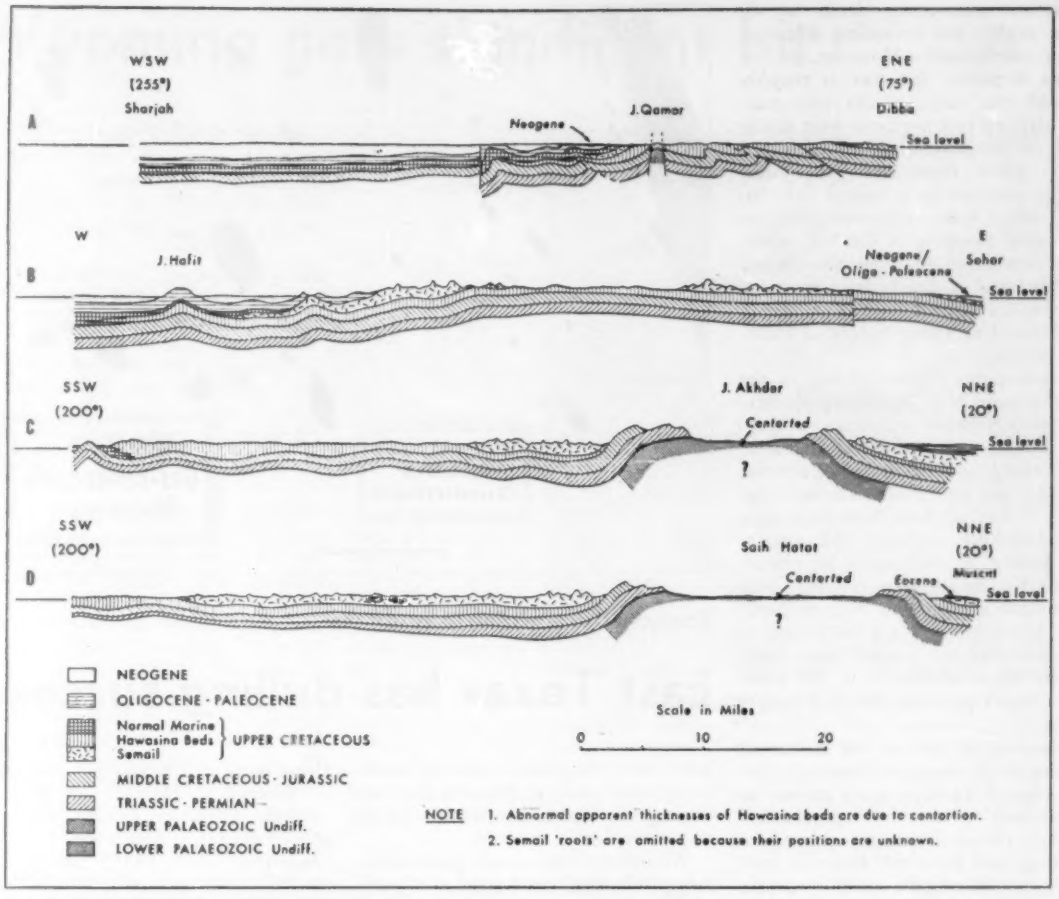
The detailed structure of the Oman Mountains (Fig. 4) is still imperfectly known but the main events in its history are indicated by stratigraphic studies. These show that the region was a stable part of the gentle foreland basin of Trucial and Central Oman until the end of Middle Cretaceous times. There is no evidence to suggest that any Mesozoic geosynclinal zone developed to the east, where the Gulf of Oman subsided at a much later (post-Oligocene?) date.

The first movements recognizable in Oman are indicated by metamorphism and tectonic repetition of the Hatat phyllites, which are not likely to have resulted from, or followed, the broad folding of the Saih Hatat and Akhdar domes in which they appear. Since these dynamic effects increase downwards in the deeper, incompetent core of the structure, diminishing and disappearing upwards in their competent cover, they may have been caused by slight underthrusting of a peneplaned basement.

Local uplift due to this or some other case, began at or towards the end of the Middle Cretaceous, when basal Hawasina breccias and conglomerates appeared with derived faunas, indicating contemporaneous axial emergence and erosion. In the overlying Hawasina units, huge slumped masses of Permian—Jurassic sediments point to move violent local distruption and probably block movements, accompanied by premonitory vulcancity (tuffs; basic extrusions). Associated silica enrichment of the sea water favored the deposition of radiolarites which are often chaotically slumped and contorted. The regime was evidently one of continued regional subsidence with local uplift and archipelago conditions.

This history culminated in the extrusion of ophiolite "nappes" on an immense scale, and probably in a viscous form and a local low-grade dynamo-thermal metamorphism of immediately underlying beds; and in underlying beds; and in slight shearing of ophiolites already consolidated. These generally rest on Hawasina beds, but at Jabal Rann (near Qamar) they overlie a truncated, uplifted dome or block of Rann-Ordovician quartzites and shales.

Semail extrusion, from "roots" so



STRUCTURAL CROSS-SECTIONS of Oman Mountains are not completely known, but the main events in its history are indicated by stratigraphic studies. Fig. 4.

far undiscovered, was probably accompanied by continued subsidence; the upper part of the serpentinites is sometimes conglomeratic, suggesting emplacement under submarine conditions. However, uplift and axial erosion followed quickly, with deposition of flanking basal Maestrichtian conglomerates, probably including the Ajma boulder beds.

Apart from gentle oscillations which controlled subsequent transgressions and regressions, there is little evidence of further activity in the Oman Range until post - Oligocene, pre - Miocene folds appeared on the west flank. It was probably at this time that axial uplifts were accentuated, tilting their Semail-Hawasina cover; and that thrusting occurred on a large scale in the north and on a minor scale elsewhere, together with wrench faulting. The anomalous northeast-southwest trend of the Jabal Nakhl, paralleling the Wadi Semail Gap, is attributed to transcurrent movements.

The Neogene folding on the west flank is confined to a narrow belt of widely-spaced anticlines, some very irregular with minor thrusts, exposing steep-dipping Oligocene to Cretaceous formations overlapped by gentlytilted Miocene. Trending to Hafit, the folds swing eastward in the latitude of Ras al Hadd, terminating as they approach the mountain front. These structures were interpreted by Lees as elements of an independent fold-arc continuing, perhaps, towards Sind. However, it is considered that they are related to endemic, deep-seated fault-tectonics in Oman, and in some cases (Fahud) to associated salt diapirism at depth.

Geophysical surveys in the Sharjah area show that the north-south strike swings abruptly northeast at Juweiza, into approximate parallelism with the Pirate Coast and the "Dibba Line" wrench fault (Fig. 3); faulting and great thickening of sediments are indicated towards the adjacent coast.

General emergence of Oman followed the Miocene, but successive erosion terraces in the mountains indicate that the range itself underwent differential uplift in stages.

The Desert . . . Most of the desert foreland is covered by flat-lying marine Oligocene or Miocene deposits, or by recent dune sands and salty mudflats (Fig. 2). However, deeper exposures occur in coastal Dhofar, and in the broad, gentle Hugf-Haushi swell, trending northwards for 100 miles from Ras Duqm. This is an old elevated feature with unconformable Paleozoic, Mesozoic and Tertiary deposits converging upon its flanks.

Structure

The desert region can be subdivided structurally as follows:

In the south-coastal belt, the broad tabular Hugf-Haushi swell can be seen trending north northeast-south southwest with a core of Lower Palaeozoics running from Duqm to Latitude 21°, and bounded on the west by a scarp exposing Mesozoics and Tertiaries with low dip. Some of these unconformable deposits reappear on the east flank in the southern sector.

Stratigraphic observations show that differential block movements of various ages from Palezoic onwards have affected this feature; it is cut by

numerous intersecting faults at diverse angles, the prevailing direction being north-south. However, in its grosss structure, the core is roughly divided into major blocks with margins striking east northeast-west southwest to northeast-southwest; and the latter trend dominates geophysical survey patterns in a coastal belt 50-100 miles wide, reappearing in the geological mapping of the Sur sector. It is considered that the prominence of this trend is due to movements of the Masira wrench-fault zone which may have had a long history of recurrent activity.

There is no regular folding in the Hugf-Haushi area, but there are several widelyspaced anticlines, averaging 7 miles (max. 20 miles) in length, and rising anomalously, sometimes sharply, out of tabular surroundings (Fig. 1). Two of these folds strike east northeast-west southwest, the remainder having a north-south alignment. Most of them are very irregular, with associated normal and wrench faulting. The structures are attributed to the interplay of vertical and horizontal block-movements in the basement which probably lies at no great depth.

The area to the west and northwest of the Hugf scarp is extremely flat and dips of Tertiary strata cannot be ascertained. However, geophysical surveys reveal important subsurface faulting, and local salt tectonics generally associated with faults at depth. At several points salt plugs pierce the horizontal cover, but only one of these reveals peripheral dips (3°) in the Miocene overburden.

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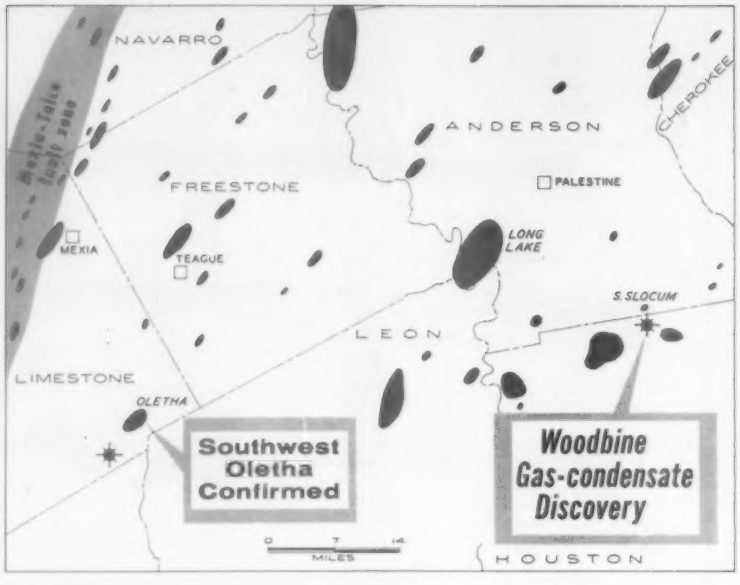
New gas-condensate well for Gulf Coast

New gas-condensate production is being opened in a discovery by D. H. Locke a mile northwest of oil production in South Moss Hill field, Liberty County, Texas Gulf Coast.

Discovery well, 1 Livingston, is rated good for 8,200 M.c.f.d. of gas, calculated open-flow potential. Flow through 12/64-in. choke was gaged at 1,320 M.c.f.d. with pressure of 2,106 psi. Gas-liquid (62°-gravity condensate) ratio is 207 M.c.f. per barrel.

Location is 5 miles north of Moss Hill.



Rodessa, Woodbine tapped as . . .

East Texas has drilling success

THE TREND toward gas-condensate exploration in East Texas is fast becoming the most successful wildcatting campaign in the area.

Woodbine Cretaceous gas-condensate production was tapped at a wildcat 4 miles northeast of Grapeland and just south of the Houston-Anderson County line. The discovery well is Globe Drilling Co. 1 Keen Gas Unit on the J. G. Harding Survey, A-1115, 1½ miles south of Woodbine gas production at South Slocum field.

This new producer flowed open 56,500 M.c.f.d. plus 20 bbl. of condensate per million. Production is from the Woodbine through perforations at 5,985-87 ft. The well produces from the top 2 ft. of a 10-ft. pay section.

In southern Limestone County, Three States Natural Gas Co. 1 Connell Unit is the Rodessa confirmation to the discovery well of Southwest Oletha field. This well flowed open 31 M.M.c.f.d. plus 20 bbl. condensate per million. Production is from perforations in the Rodessa at 6,634-96 and 6,719-37 ft. It is the confirmation well to W. R. Hughey 1 F. D. Connell, a Rodessa and Pettet gasser. Location of the confirmation success is on the D. F. Davis Survey.

The discovery well of Southwest Oletha field flowed 37 M.M.c.f.d. plus 28 bbl. condensate per million; 2,450 M.c.f.d. and 17 bbl. condensate per million from the Pettet.

Other news . . . A new pay discovery is reported at Harold Orr field in northern Robertson County. Like the above strikes, production is gas-condensate. B. B. Orr 2 George Abraham flowed open 6 M.M.c.f.d. plus 8 bbl. condensate per million from perforations in the Travis Peak at 7,304-10 ft. This new pay hit is 4½ miles east of Bremond and on the Dennis Hagerty Survey. Harold Orr field produces from Edwards lime and Nacatoch.

Prolific Colorado pay is reported

A prolific Dakota Cretaceous gas discovery is reported in La Plata County, southern Colorado.

Pacific Northwest Pipeline Co. gaged 62 M.M.c.f.d. at 6 Ute Indian-B, SE SE NW 17-33n-7w. The new strike is in San Juan basin's Ignacio-Blanco field, more than 4 miles north of closest Dakota production.

Pacific Northwest is working over the well, drilled in 1956 by Stanolind Oil & Gas Co. Stanolind had only deep rights and did not test above Morrison. After plugging back to 7,632 ft., eight zones of the Dakota were perforated between 7,382 and 7,588 ft. Following acidization, the well flowed 10 M.M.c.f.d. and 62 M.M.c.f.d. was gaged after sand fracture. The new well is one of Colorado's biggest gassers.

Wyoming gets significant hit

WYOMING may have its most important oil strike of the year. It is The California Co.,s 1 Waltman Unit oil find in NE SW 31-37n-86w, Natrona County, southeastern Wind River basin.

The significant discovery flowed 200 bbl. of oil daily from perforations at 5,680-94 ft. on a 16/64-in. choke. This well is northeast of the 2 Unit, NW SE 1-36n-87w, the discovery well on the 14,258-acre unit. That well flowed 2,300 M.c.f.d. plus 74 bbl. condensate from another zone in the Lance.

New oil pay . . . The Lance has never produced oil in Wyoming. There is some production from the formation at Hiawatha field in the southern Green River basin. Two other fields in the state, both in Wind River basin, have Lance gas production. One of them, Badwater Unit, is the deepest producer in the entire Rockies at 17,-000 ft. The other field is Lost Cabin where both Tertiary-Wind River and Upper Cretaceous Lance produce.

The Lance is the uppermost formation in the Upper Cretaceous. It lies just below the contact of Cretaceous and Tertiary rocks in the Rockies. It is widespread in the Wind River basin, ranging in thickness from a wedge to nearly 3,000 ft.

Thrust-fault . . . The Waltman Unit lies on a highly faulted and thrusted structure in the southeast part of Wind River basin. The Lance was present at the surface in the 1 Unit discovery, a Lance fault was found at 1,470 ft., and it was found again at 5,300 ft.

Highly significant . . . This Lance discovery could be of great significance for future drilling in Wind River basin. The finding of production in the Tertiary Wind River formation last year in the Lost Cabin area on the highly complex north flank of the basin set off a brisk hunt for that zone. There had been little production in the state before that hit. Now with first oil in the Lance, Wind River operators have another new target to shoot for. The third well at Waltman is already underway. Calco is stepping out 1 mile on each location to evaluate the size of the gas producing area on Waltman unit. There is no mention of their plans for oil development.

The Rocky Mountain province is always full of geological and oil surprises. Wyoming has had more than its share in the past couple of years. A few years back Mesaverde production was practically unheard of except in the San Juan basin and other southern Rocky Mountain areas. Then it jumped hundreds of miles north to Wyoming. The Tertiary is hardly touched in the state's many basins. Lance success at Waltman should signal a search for more production from this formation.

FIRST oil production from the Lance formation in Wyoming may stir a brisk search into the possibilities of this nearly unknown pay.

Alberta scores three big strikes

ALBERTA'S last three major gas-discovery wells, Worsley, Burnt Timber, and Lookout Butte, have substantially added to the province's gas reserves.

Although all three of the wells are either still drilling or in the process of being completed, indications of drill-stem tests, plus thickness of zone, porosity permeability etc., already have assured their backers of better than commercial production.

It has only been within the last year that the "big" discoveries of gas have been uncovered in western Canada. It all started when British American Oil Co., Ltd.-Shell Oil Co. of Canada, Ltd., found a prolific D3 reef in the Berland River district of West Central Alberta. That venture was completed with a potential in excess of 1½ billion cubic feet daily. Then came Gulf States Oil Co. of Canada, Ltd.'s, Beaverhill Lake strike in northeastern British Columbia which may rival even that high potential.

Worsley . . . Although two of the newest major discoveries are thought to be smaller than Berland River or Kotcho, one of them is rumored to be bigger. That one, Shell Oil's 14-19-87-7 Worsley, is apparently in a class all its own and although not confirmed by company officials the potential is said to be large.

It is located some 35 miles east of oil production in Boundary Lake oil field and lies about 75 miles northwest of Peace River town site. Discovery on this hole is the D3 Leduc reef which came in around the 7,220-ft. level. Only official information released on the well to date indicates that it contains a gross pay sector of around 162 ft. and during initial tests, through the drill stem, flow rates of up to 8 M.M.c.f.d. were measured. Completion tests on this strike are now in progress and it is expected that an official release will be made on the results of those in the very near future.

Burnt Timber . . . Shell is also responsible for one of the other discoveries highlighted. That venture, in the Burnt Timber Creek region of southwestern Alberta, is still being drilled and is still in the Mississippian.

British American's Lookout Butte 11-31-1-28 appears to be a tremendous

August footage review

	FIELD WELLS					WILDCAT WELLS			
	Oil	Cond.	Gas	Dry	Service	Oil	Cond	Gas	Dry
Alabama	34,805								9,851
Alaska									23,430
Arizona						6,080			11,850
Arkansas	75,536		10,406	71,140		7,213		7,755	24,978
California	312,431		12,420	49,859	14,707	14,517		34,965	191,596
Colorado	46,607	5,983	5,600	65,553	4,978	30,103		13,406	161,561
Florida									15,475
Illinois	294,876		1,390	169,523		17,994			99,117
Indiana	28,366			45,187		4,847			28,348
Kansas	526,253	6,100	28,205	275,465	18,509	47,520		17,364	286,047
Kentucky	45,895		187,893	38,098	411	5,526		1,828	28,657
Louisiana	1,067,479	347,728	76,654	589,638	2,600	36,167	26,250	9,151	377,450
North	167,208	8,279	63,053	155,841				9,151	133,478
South	788,604	293,866	13,601	322,002	2,600	21,600	26,250		214,459
Offshore	111,667	45,583		111,795		14,567			29,513
Michigan	87,357			17,913	18,733			4,910	46,621
Mississippi	197,880			44,736		18,451			129,305
Montana	51,349			32,051					31,987
Nebraska	122,235			143,260		5,800			240,614
New Mexico	487,741	52,429	159,899	114,897	4,931	25,856			195,641
West	202,055	52,429	138,288	29,734	4,931				15,882
East	285,686		21,611	85,163		25,856			179,759
New York	15,252		2,975		9,320				7,807
North Carolina									16,110
North Dakota	121,341			29,205					27,580
Ohio	87,328		78,721	34,931	20,131			3,458	15,594
Oklahoma	808,386	13,527	103,813	246,403	29,910	29,357	4,375	32,496	322,520
Pennsylvania	34,291		89,738	12,645	23,641				2,605
South Dakota	17,225								
Tennessee									4,323
Texas	3,203,533	405,058	230,460	971,455	45,751	119,071	22,272	20,405	1,282,741
Dist. 1	82,903		32,039	40,575		10,943			83,529
Dist. 2	57,211	49,644	3,328	83,066		17,400	7,515	6,305	104,528
Dist. 3	224,735	159,945	2,798	170,638	2,211	11,994			103,333
Dist. 4	137,962	62,640	53,897	158,955		3,010	5,511	10,000	149,749
East	310,788	25,926		57,630					111,564
Dist. 7-B	258,072	4,411	7,267	106,749	1,218	24,981	4,166	4,100	141,440
West	1,641,998	50,184	9,341	148,011	3,860	45,026	5,080		380,826
Dist. 9	263,375		49,654	154,577	29,463	5,717			152,630
Dist. 10	226,489	52,308	72,136	51,254	8,999				55,142
Utah	32,072			17,353		6,200			18,968
West Virginia	15,048		163,520	30,074	10,594			18,944	6,714
Wyoming	215,443	9,573	7,493	83,298	18,925	7,432		4,843	179,695
Total U. S.	**7,928,729**	**840,398**	**1,159,187**	**3,082,684**	**223,141**	**382,134**	**52,897**	**169,525**	**3,787,185**
Western Canada	**515,377**		**90,504**	**70,806**		**35,833**		**33,061**	**118,544**
Alberta	369,378		67,526	49,013		15,064		24,123	83,010
Saskatchewan	140,106		4,801	17,691		15,958		3,711	26,960
Manitoba	5,893								1,258
British Columbia			18,177	4,102		4,811		5,227	7,316

find. That test, about 10 miles due south of Pincher Creek gas field, is also still in the Mississippian. Although this well is thought to be larger than any of those in the Pincher Creek field, the extent of the structure is not supposed to be as big.

Michigan well confirms new field

In Michigan McClure and Covey 1 Van Wert, SE SE SE 8-6s-2w, Adams Township, Hillsdale County, flowed 20 bbl. oil per hour on 12/64 in. choke from Black River dolomite to confirm new pool discovery. Located 4½ miles southeast of Scipio field, outpost was perforated with 24 shots at 3,981-90 ft., followed with 50 gal. mud acid. Trenton section, major producing zone to the northwest, was dry.

New pool indicated by Ohio well test

Tests indicate a new pool in northwest Westfield Township, Medina County, Ohio. E. J. McBride reports production in the Clinton at 3,078-93 ft. at the 1 M. H. Henning, Section 12. The operator gaged 778 M.c.f.d. natural and 3,600 Mc..f.d. after fracture. Rock pressure was 1,050 psi.

● East Ohio Gas Co. completed the 1. T. H. Bailey, Section 1, Edinburgh Township, Portage County. This test logged the Clinton at 4,298-4,357 ft. Following fracture, flow was gaged at 602 M.c.f. natural and 7,530 M.c.f. This area, about ½ mile south of Cambellsport, is the site of very limited drilling activity.

Nebraska may have new commercial pay

Commercial possibilities are indicated at a new strike in Nebraska's Denver basin.

Miracle-Fifer Drilling Co. recovered 2,610 ft. of oil with 600 ft. of gas-cut water on a 1-hour drill-stem test of a wildcat 1½ miles east of Pinto field, Kimball County. The well is 1 Evertson, C SW NE 30-16n-56w.

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Drill-stem test was made in the "J" sand at 6,665-67 ft. Flowing pressure was 115 psi. initially, reached 804 psi. by the end of the test. Tests in this limited interval indicate commercial possibilities. Miracle-Fifer is running production string at 6,740 ft.

East Kentucky well drilling ahead

In Bell County, a short distance east of Pineville, United Fuel Gas Co. is drilling at 1,400 ft. at its wildcat 1 J. Knuckles. Test is a scheduled deep hole and is being drilled near the Pine Mountain thrust fault.

Oklahoma's Morrow play picks up new pair

Northwestern Oklahoma's Morrow Pennsylvanian campaign picked up two more discoveries last week. Amerada Petroleum Corp. has one in Dewey County; Texaco, Inc. has another one in Dewey County.

The Dewey County sector of this play is south of Woodward and southeast of Ellis County. Amerada's 1 Brewer in NE SW 23-18n-18w found the Morrow at 10,273 ft. A drill-stem test of the interval 10,273-10,313 ft. got 7 M.M.c.f.d.

Location of this remote strike is 6 miles west of the town of Taloga.

Texaco's discovery is the 1 Devereaux in C NW SW 9-17n-14w. The well flowed up to 6,094 M.c.f.d. from perforations in the Morrow at 9,490-9,500 and 9,516-76 ft. There was also condensate.

Panhandle centers on Anadarko drilling

The Oklahoma Panhandle's Cimarron County is becoming more and more important as a producer in the booming campaign for production in the western Anadarko basin. Southeast Griggs field appears to be the center of this push. The newest addition to the growing field is Texaco, Inc. 1 Chuman in C SW SW 24-1n-9eCM.

This well flowed 22,500 M.c.f.d. from perforations at 3,410-16 ft. and 4,277-4,316 ft. Fracturing followed earlier tests. After the treatment, the well flowed the big gas volume. This field is a multipay reservoir in the southeast corner of the county. There is production from several Pennsylvanian sands in the field. It is one of the most important reservoirs in this area.

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New dome produces in East Texas

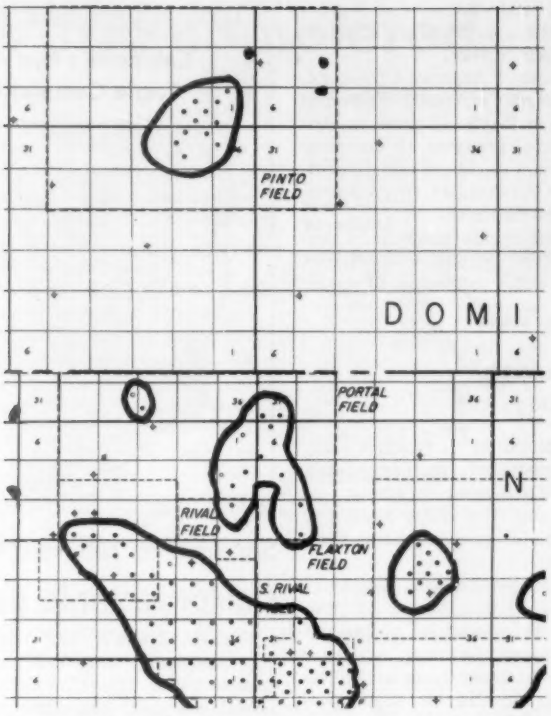
A NEW Woodbine Cretaceous discovery is reported on Butler salt dome in southeastern Freestone County.

Whiffen Estate, Inc., of Dallas is testing at 1 Daniel Memorial Orphanage. The well, located about 2 miles east-southeast of Butler, is flowing at rate of 8 bbl. per hour through ¼ in. choke. Production is from perforations in Woodbine where log indicated 12 ft. of pay. This is East Texas' newest productive salt dome.

New strike seen for northern Texas

Drill-stem testing is recovering a significant amount of free oil in the Mississippian formation in southeastern Baylor County. Diversa, Inc., and Hal C. Newman, testing the 1 Lilly V. Martin at 5,318-63 ft. report oil to the surface in 12 minutes. This potential discovery is 1¾ miles northwest of East Westover (Caddo) field.

A subsequent test in the Mississippian lime at 5,363-5,400 ft. had gas to surface in 4 minutes with tool open 20 minutes. Recovery was 4,650 ft. of oil, 150 ft. of mud-cut oil, and 10 ft. of water. The operator is now testing at 5,400-40 ft.



HERE is a portion of a fine new map of the northern portion of the Williston basin. The map goes 60 miles north of the International border into Saskatchewan and Manitoba, and 60 miles south of the border into North Dakota. The map covers from the western side of Divide County going east to the eastern county line of Bottineau County. All fields are shown according to Canadian government regulations; the same on the North Dakota side. This map is available from Northwest Mapping Co. at 117½ Fourth Street, Bismarck.

Rank wildcat staked in Texas' Hardman

Location has been announced for an Ellenburger exploration in the southeastern tip of Palo Duro basin, North Texas.

Sinclair Oil & Gas Co. 1 W. M. Judd is on a 633-acre lease in Section 399, Block A, H&TC Survey, in south-central Hardeman County. The well location is 7 miles southwest of Medicine Mounds townsite and approximately 10 miles south of Conley-Mississippian field. Projected depth is 7,500 ft.

Deep test set for Martin County in Texas

Martin County, in West Central Texas, is in line for a 12,500-ft. Ellenburger exploration at Great Western Drilling Co. 1 Leonard M. Allen.

The project is 9 miles northeast of Midland and ⅜ mile northwest of the depleted Stanton (Ellenburger) field discovery. Location is on a 320-acre lease in Section 41, Block 37, T1N, T&P Survey.

The Stanton field discovery was Tidewater Associated Oil Co. 1 Dickenson. It was completed in 1951 for 234 bbl. of oil a day from pay at 12,085-12,105 ft. but production went to water rapidly. Later workover attempts were unsuccessful. No. 1 Dickenson drilled into the Ellenburger at 12,090 ft.

West Texas wildcats report oil shows

Exploration tests in two West Texas counties reported oil shows on drill-stem tests. In northeastern Ector County, Texas Gulf Producing Co. 1 Barrow recovered 90 ft. of oil and 540 ft. of heavily oil-cut mud on a test of the Pennsylvania Bend section at 10,785-10,890 ft. Flowing pressure was 640 psi., increasing to 4,150 psi. when shut in. Drilling continued below 11,000 ft.

An earlier test of the Atoka section at 10,500-85 ft. recovered 30 ft. of 42° oil and 240 ft. of heavily oil

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and gas-cut mud. Location is 3 miles north of Odessa in Section 27, Block 42, T1S, T&P Survey.

Ralph Lowe 1 Superior-University, new-pay prospect offsetting Wolfcamp production in Block 11 field in Andrews County, prepared to complete as a Fusselman discovery after a drill-stem test at 8,141-8,241 ft. recovered 750 ft. of oil-cut mud.

No. 1 Superior-University is in Section 27, Block 11, University Lands Survey, 12 miles northwest of Goldsmith.

Deep Louisiana drilling pays off

Deep exploration in North Louisiana has uncovered another Cotton Valley field, located northeast of Blackburn and 3½ miles northwest of Homer field, in west-central Claiborne Parish.

Discovery is by Magnolia Petroleum Co. at its 1 Thelma Worley, C SW NE 34-22n-8w, productive of gas and condensate from two zones.

The well is dually completed. The lower zone, the Taylor sand, perforated at 10,286-10,335 ft., tested 130 M.c.f. of gas and 7 bbl. of 52°-gravity condensate per day through ⅛-in. choke. Flowing pressure was 610 psi.

The upper pay, the Davis sand, perforated at 9,228-36 ft., flowed 1,263 M.c.f. of gas and 104 bbl. of 63°-gravity condensate per day through 12/64-in. choke with pressure of 2,573 psi.

Total depth of the hole is 10,507 ft. with 5½-in. casing cemented at 10,502 ft.

New discovery for Texas' Galveston

A deep wildcat a mile south of the prolific Red Fish Reef field in Galveston Bay, Texas Gulf Coast, has been completed as a good oil-discovery well.

It is being set up as a separate field, designated as South Red Fish Reef field. Location is in Galveston County, just over the Chambers County line.

Humble Oil & Refining Co.'s discovery well, 95-A Galveston Bay, in Tract 285, is good for 288 bbl. of 36.4°-gravity oil per day, restricted to 12/64-in. choke. Gas-oil ratio is 351 cu. ft. per bbl. Flowing pressure is 1,000 psi.

Production is from casing-perforated interval at 11,406-16 ft. in hole drilled to 12,780 ft. Pay is in Frio sand.

Sacramento play marks California triple pay

CALIFORNIA'S first triple zone gas completion was brought in by Brazos Oil & Gas Co. in the River Island gas field, Sacramento County.

The well, 2 S. R. Unit 1, is located in NE NW 20-4n-4e, about 4 miles northeast of the small community of Isleton. Originally drilled to 10,000 ft., it was plugged back to 5,472 ft. for the triple completion in these intervals:

... **The lower zone** Lopes sand was perforated at 5,445-69 ft. for 2,200 M.c.f. daily.

... **A new middle zone** was perforated at 5,360-67 ft. for a 2,000 M.c.f. daily.

... **The upper zone,** also a new one for the area, was perforated at 4,752-58 ft. for 1,700 M.c.f. daily.

Three sets of 2⅜-in. tubing were used. Perforations were made with six ½-in. bullets per foot in each of the three zones. Also, 14/64-in. chokes were used in each zone.

New trio completed

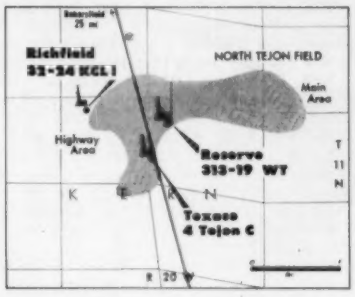
in California's North Tejon

THE HIGHWAY area in Kern County's North Tejon field picked up three good wells when three companies completed extension tests in separate parts of the area.

Here's what happened:

. . . **Richfield Oil Corp.** proved up additional acreage with a well which ranks as the most westerly extension in Highway area. The well, 32-24 KCL I, is located in NE NW 24-11n-20w. For completion, it was perforated in the Z-1, Z-5 and Z-6 zones for a combined 310 bbl. daily of 33.3°-gravity crude through an 18/64-in. choke. Perforations are between 9,472-9,513 ft., 10,284-89 ft., and 10,396-10,402 ft. Total depth is 12,-022 ft.

. . . **Reserve Oil and Gas Co.** scored with a test on the east edge of the area in SW NW 19-11n-19w. It was completed in two zones. The upper between 9,078-9,490 ft. was brought in flowing 870 bbl. daily of 35.2°-gravity crude through a 30/64-in. choke. The lower was perforated at 10,910-11,004 ft. and 11,279-11,686 ft. On a test, it flowed a to 4 M.M.c.f. of gas and 150-200 bbl. daily of condensate. The lower zone is shut in.



CALIFORNIA development news continues to center in the North Tejon area's Highway field.

. . . **Texaco, Inc.** extended production in the extreme southeast edge of the Highway area with a well in SW SW 19-11n-19w. The Texaco well, 4 Tejon C, was making 202 bbl. daily of 34.7°-gravity through an 18/64-in. choke from perforations at 8,987-9,157 ft.

With these completions, Reserve was running four other rigs in the field and Richfield two others. Texaco was idle for the moment there.

Big tract set for Colorado leasing

A large tract in the Colorado State Forest will be leased in one block for exploration and drilling rights at a public auction 2 p.m., October 7 in the State House of Representatives Chamber at Denver.

The 10,447-acre tract is located in the 70,000-acre state forest near Walden in North Central Colorado. Carter Oil Co. made the request that the acreage be put up for competitive lease bidding.

W. H. Pattison, who directs mineral leasing for the State Land Board, says applicants must bid at least 60 cents per acre per year on a 5-year lease. The state will receive a one-eighth royalty on all production.

Proceeds from leasing the state forest land must be earmarked for the public schools.

The tract is the largest ever put up for lease for mineral exploration in the state forest.

NEXT WEEK

South Central New York State a possible

Sleeper

Gas-condensate find confirmed in Louisiana

Discovery last May by J. C. Trahan Drilling Co. of a new gas-condensate field 2 miles east of Kraemer field in northern Lafourche Parish, Louisiana Gulf Coast, is being confirmed by the operator's second well.

The new well, 2 Bowie, northeast of the initial well, is completed with a flow rate of 118 bbl. of 52.6°-gravity condensate and 1,450 M.c.f.d. from pay about 400 ft. higher than in the discovery well. Flowing pressure is 3,700 psi.

Discovery well is productive from

Control LOST CIRCULATION better with

MASTERPLUG*

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PERRYTON, TEXAS

LAFAYETTE, LOUISIANA

perforations at 12,980-90 ft. Confirmation well is completed at 12,422-28 ft.

The new area, Bayou Chevriel field, is just south of the point of intersection of St. James and St. John the Baptist parishes.

Discovery wells

CALIFORNIA

Glenn County: B.B.B. Oil Enterprises 1 McHatton, NE SE 1-18n-2w, 1,848 M.c.f.d., ½-in. choke, perfs. 6,962-66 ft., 6,974-99 ft. and 6,968-70 ft., TD 7,100 ft. (Extension test ¾ mile northeast of production in Bounde Creek area of Princeton gas field.)

Sacramento County: Brazos Oil & Gas Co. 1 S.R. Unit, NE NW 20-4n-4e, triple completion, upper zone at 4,752-58 ft. flowed 1,700 M.c.f.d., middle zone at 5,360-67 ft. flowed 2 M.M.c.f.d., lower zone at 5,445-69 ft. flowed 2,200 M.c.f.d., TD 10,000 ft. (Middle and upper zones are new in this area of River Island field.)

ILLINOIS

Clay County: Gulf Oil Corp. 2 Myrtle Strange, NE NW SW 5-2n-7e. IP 178 BOPD, 95 BWPD, Aux Vases 2,971-82 ft., Rosiclare 3,074-80 ft., McClosky 3,088-97 ft. TD 3,152 ft. New pay in West Seminary pool (McClosky).

Texaco, Inc., 7 H. D. Allen "A," SW NE NE 36-3n-5e. IP 41 BOPD, 15 BWPD, Carper 4,219-31 ft. Devonian 4,447-57 ft., 4,488-4,509 ft. TD 4,624 ft. New pay in Kenner pool.

KANSAS

Barton County: Irving Hardman 1 Deines, NW NW SW 16-16s-14w. IP 28 BOPD, 50% bw. 34°, Lansing-Kansas City 3,332-36 ft. TD 3,512 ft. Opens Deines field.

W. H. Pitts 1 Chuck Finn, SW NW SW 31-17s-13w. IP 5 BOPD, 35°, Lansing-Kansas City 3,158-60 ft. TD 3,365 ft. Opens Finn pool.

Thunderbird Drilling Co. 1 Barnes "A," NW NW SE 20-18s-11w. IP 35 BOPD, 30% bw., 30°, Arbuckle 3,411-28 ft. TD 3,459 ft. Opens North Feist pool.

Raymond Oil Co. 1 Unruh, NE NE SE 25-20s-15w. IP 45 BOPD, 37.5°, Arbuckle 3,636-37 ft. TD 3,645 ft. Opens South Unruh field.

Kaiser-Francis 1 Hood, SW SE SE 30-20s-12w. IP 29 BOPD, 38°, Lansing-Kansas City 3,299-3,301 ft. TD 3,440 ft. Opens Hood field.

Ellis County: Birmingham & Bartlett 1 Oswald "C," SW SW NE 2-12s-16w. IP 125 BOPD, 6% bw., 34.5°, Lansing-Kansas City 3,230-38 ft. TD 3,415 ft. Opens new pay at Blue Hill.

Grant County: Hugoton Production Co. 2-19 Winger, C SE NE 19-29s-37w. IPF 6,726 M.c.f.d., Council Grove 2,739-2,880 ft. TD 5,860 ft. New field inside Hugoton field.

Harper County: Walters Drilling Co. 1 Zuercher, SW SE SW 9-32s-7w. IP 132 BOPD, 4,722-35 ft. TD 4,913 ft. Opens Zuercher field.

Harvey County: J. P. Gaty 1 Ulmer, SE NW SW 36-24s-2e. IP 11 BOPD, 41°, Burgess sand 2,835-46 ft. TD 2,846 ft. Opens East Dubois field.

Hodgeman County: Hinkle Oil Co. 1 Goebel, NE NE NW 14-21s-24w. IP 51 BOPD, 65% bw., 37.4°, Mississippian 4,446-58 ft. TD 4,515 ft. Opens Goebel field.

Meade County: Skelly Oil Co. 1 Carl Evans, C SE SW 1-33s-29w. IPF 7,550 M.c.f.d., Morrow 5,612-20 ft. TD 5,752 ft. New field.

Ness County: O. A. Sutton and CRA 1 Boyd "A," SE SE SE 25-19s-24w. IP 114 BOPD, 38% bw., 40°, Cherokee 4,278-90 ft. TD 4,837 ft. Opens Franklin field.

Reno County: Harms-Burt Drilling Co. 1 Gregg, SE SE NW 6-22s-9w. IP 45 BOPD, 40% bw., 43°, 3,611-18 ft. TD 3,656 ft. New pool.

NORTHWEST NEW MEXICO

San Juan County: Benson-Montin-Greer Drilling Co. 2 Fullerton, SE SE 28-28n-13w. IPF 3,958 M.c.f.d., Dakota discovery, new field. TD 6,280 ft. Dakota.

1 Fullerton, NE NE 34-28n-13w. IPF 5,579 M.c.f.d., Dakota discovery, new field. TD 6,363 ft. Dakota.

Tennessee Gas Transmission Co. 8 Glenn Callow, SW SE 27-29n-13w. IPF 514 BOPD, Gallup: IPF 3,010 M.c.f.d., Dakota. TD 6,031 ft. Morrison. Gallup-Dakota discovery, new field.

NORTH DAKOTA

Bottineau County: Amerada Petroleum Corp. 1 Warner, C SW NE 27-162n-80w. IPP 10 BOPD, 43 BWPD, Midale discovery, new field. TD 3,503 ft.

OKLAHOMA

Beaver County: Cabot Carbon Co. 1 Ralph Barby "B," C SW NE 24-5n-26eCM. IPF 10 M.M.c.f.d., Morrow 6,770-76 ft., 6,784-94 ft. TD 7,050 ft. New field.

Dewey County: Sinclair Oil & Gas Co. 1 E. S. Collier, C NE NE 15-17n-18w. IPF 9,020 M.c.f.d., Tonkawa 7,527-37 ft., 7,543-60 ft.; Oswego 9,174-98 ft.

Ellis County: Pan American Petroleum Corp. 1 Phillips Gas Unit, C SW NE 15-24n-24w. IP 34 BOPD, 24 BWPD, 40°, Tonkawa 5,835-39 ft. TD 7,950 ft. New field.

Grant County: Anderson-Prichard 1 W. C. Arnold, C SW SE 8-27n-8w. IP 19 BOPD, 33.5°, 59 BWPD, Cherokee 5,222-36 ft., 5,236-62 ft. TD 5,315 ft.

Harper County: Gulf Oil Corp. 1 Hieronymus "F," 13-28n-24w. IPF 3,710 M.c.f.d,. Morrow 6,108-18 ft.; Chester 6,149-53 and 6,176-81 ft. TD 6,452 ft. New pay in unnamed field.

Sinclair 1 H. E. Rohrer, C SE SW 20-29n-22w. IPF 7,592 M.c.f.d., 36 BOPD, 54°, Morrow 5,701-11 ft. TD 7,836 ft. New field.

McClain County: Fain-Porter Drilling Co. 1 Vierson, N½ NE SE 8-6n-3w. IPF 384 BOPD, 40°, Bromide 11,906-16 ft. TD 11,230 ft. New field.

1-A Hester, E½ SW SE 9-6n-3w. IPF 102 BOPD, 40°, Hunton 9,154-96 ft. TD 9,275 ft. New field.

Major County: Livingston Oil Co. 1 Keck, C NW NW 14-21n-12w. IPF 5,700 M.c.f.d., Cherokee 6,788-20 ft. TD 7,052 ft.

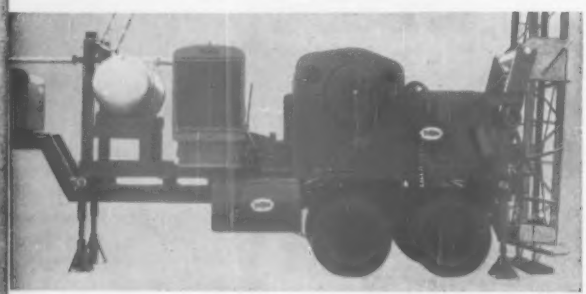
Oklahoma County: Harper Oil Co. and Ambassador Oil Co. 1 McGill, NW NW SE 6-14n-3w. IP 17 BOPD, 39°, second Wilcox 6,660-82 ft. TD 6,682 ft. New field.

Okmulgee County: Webco Drilling Co. 2-A Watson, SW SE SE 12-11n-13e. IPF 10,100 M.c.f.d., Cromwell sand 2,340-43 ft. TD 2,357 ft.

Osage County: Jet Petroleum Co. Osage, NW NW NE 22-21n-9e. IP 156 BOPD, 40°, Tyner 2,788-2,808 ft. TD 2,889 ft.

Sunray Mid-Continent Oil Co. 1-A Drum-

9,000-FT. SERVICE UNIT ...8 FT. WIDE!



WICHTEX Model F-75-Heavy-Duty . . . truck or trailer mounted . . . is recommended to 9000 feet with an 87-foot or 65-foot fabricated telescoping derrick, or double telescoping 65′ x 7″ x 8″ mast, or double telescoping 87′ x 8″ x 10″ mast. Equipped with air friction clutches, air or hydraulic friction cathead, and winch mounted to raise mast. Write for specifications:

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WICHTEX MACHINERY COMPANY

P. O. Box 2250 WICHITA FALLS, TEXAS

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100% logging and perforating quality at 20% less cost with WESTERN'S NEW TYPE 10 UNITS

- ★ Fully quantitative nuclear logging
- ★ Superior perforating — including Rocket J-II, F.I. and all Western exclusive perforating services
- ★ Only service units custom-engineered to actual production requirements
- ★ 20% average cost savings to you in 13 of 14 jobs

unit for depths of 10,000 to 18,000 ft. needed on of wells drilled.

custom designed unit for operational depths to 10,000 ft. ideal for wells drilled.

WESTERN Engineered WELL SERVICES

ENGINEERING LEADERSHIP 20 YEARS 1939-1959

Combination of quantitative nuclear logging and highest quality perforating services is available for the first time with Western's newest contribution to well servicing technology — Type 10 combination units.

With 92% of Southwest wells completed at less than 10,000 feet, Type 10 units are engineered for actual field requirements while saving you 20% average wire line service cost.

The Type 10 is a compact workhouse, combining hoist and logging equipment in the single, versatile unit. There is no sacrifice of quality in equipment or results.

The most modern electronic and design technology are compounded into the Type 10 — to meet well requirements determined by field studies throughout the years. Some 13 out of 14 wells are completed at depths of less than 10,000 feet, and more than 65% of cased wells require nuclear logging in conjunction with perforating. This means that large, separate units, operable to 18,000 feet and deeper, are overdesigned for all but 8% of the wire line work — yet you pay for this "extra" cost on every well with the large units.

Type 10 is the answer to today's field requirements — with highest quality logging and perforating equipment that cuts costs for you all down the line.

Take advantage of this Western engineering for efficiency and economy. Put Western engineering to work for you with the new Type 10 combination wire line unit. It's your best bet for quality logging and perforating — and at savings exceeding 20%.

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Texas: Andrews, Borger, Ft. Worth, Kermit, Lubbock, Midland, Odessa, Ranger, Seagraves, Snyder / Oklahoma: Lindsay, Oklahoma City, Temple / New Mexico: Farmington, Hobbs / Colorado: Cortez / Kansas: Liberal

August completions in the U. S.

	TOTAL COMPLETIONS							WILDCAT WELLS							
	Total	Crude	Cond.	Gas	Dry	Service	Footage	Total	Crude	Cond.	Gas	Dry	Footage	C.T.	Act. op.
Alabama	6	3	0	0	3	0	44,656	3	0	0	0	3	9,851	0	6
Alaska	2	0	0	0	2	0	23,438	2	0	0	0	2	23,430	0	5
Arizona	6	1	0	0	5	0	17,930	6	1	0	0	5	17,930	0	10
Arkansas	54	27	0	3	24	0	197,028	8	1	0	1	6	39,946	0	118
California	116	68	0	10	35	3	630,495	38	3	0	7	28	241,078	1	160
Colorado	62	13	1	3	44	1	333,791	37	5	0	2	30	205,070	0	132
Florida	1	0	0	0	1	0	15,475	1	0	0	0	1	15,475	0	1
Illinois	266	131	0	2	133	0	582,900	57	7	0	0	50	117,111	12	386
Indiana	71	21	0	0	50	0	106,748	22	3	0	0	19	33,195	60	70
Kansas	337	170	1	9	152	5	1,205,463	87	12	0	3	72	350,931	4	403
Kentucky	149	45	0	50	53	1	308,308	28	3	0	1	24	36,011	130	242
Louisiana	330	153	31	18	127	1	2,533,117	54	3	2	1	48	449,018	0	442
North	148	64	1	17	66	0	537,010	29	0	0	1	28	142,629	0	133
South	155	77	26	1	50	1	1,682,982	22	2	2	0	18	262,309	0	254
Offshore	27	12	4	0	11	0	313,125	3	1	0	0	2	44,080	0	55
Michigan	55	28	0	2	18	7	175,534	15	0	0	2	13	51,531	19	175
Mississippi	43	22	0	0	21	0	390,372	17	2	0	0	15	147,756	0	68
Montana	30	14	0	0	16	0	115,387	8	0	0	0	8	31,987	0	66
Nebraska	87	22	0	0	65	0	511,909	42	1	0	0	41	246,414	0	55
New Mexico	223	126	8	38	50	1	1,041,394	25	3	0	0	22	221,497	42	235
West	118	57	8	34	18	1	443,319	5	0	0	0	5	15,882	6	148
East	105	69	0	4	32	0	598,075	20	3	0	0	17	205,615	36	87
New York	22	12	0	1	2	7	35,354	2	0	0	0	2	7,807	22	21
North Carolina	9	0	0	0	9	0	16,110	9	0	0	0	9	16,110	9	0
North Dakota	27	18	0	0	9	0	178,126	4	0	0	0	4	27,580	0	40
Ohio	91	34	0	30	20	7	240,163	6	0	0	1	5	19,052	88	285
Oklahoma	400	218	3	25	142	12	1,590,787	71	6	1	7	57	388,748	79	734
Pennsylvania	57	18	0	24	4	11	162,920	1	0	0	0	1	2,605	44	48
South Dakota	2	2	0	0	0	0	17,225	0	0	0	0	0	0	0	13
Tennessee	6	0	0	0	6	0	4,323	6	0	0	0	6	4,323	6	11
Texas	1,462	811	49	55	525	22	6,300,746	288	22	4	3	259	1,444,489	70	1,060
Dist. 1	92	48	0	5	39	0	249,989	29	2	0	0	27	94,472	0	44
Dist. 2	49	10	7	2	30	0	328,997	18	2	1	1	14	135,748	0	43
Dist. 3	109	44	16	1	47	1	675,654	14	1	0	0	13	115,327	0	78
Dist. 4	108	30	8	10	60	0	581,724	30	1	1	1	27	168,270	4	95
East	118	81	3	0	34	0	505,908	19	0	0	0	19	111,564	0	71
Dist. 7-B	189	97	2	3	86	1	552,404	51	7	1	1	42	174,687	0	58
West	439	327	7	3	101	1	2,284,326	74	8	1	0	65	430,932	22	446
Dist. 9	247	118	0	9	104	16	655,416	44	1	0	0	43	158,347	44	97
Dist. 10	111	56	6	22	24	3	466,328	9	0	0	0	9	55,142	0	128
Utah	16	7	0	0	9	0	74,593	6	1	0	0	5	25,168	0	54
West Virginia	95	9	0	68	15	3	244,894	5	0	0	4	1	25,658	90	261
Wyoming	112	47	1	2	57	5	526,702	39	2	0	1	36	191,970	7	91
Total Aug. 1959	**4,137**	**2,020**	**94**	**340**	**1,597**	**86**	**17,625,880**	**887**	**75**	**7**	**33**	**772**	**4,391,741**	**683**	**5,192**
Total July 1959	4,728	2,338	109	304	1,819	158	19,661,677	963	82	14	27	840	4,653,794	739	5,153
Cumulative 1959	33,232	16,757	805	2,417	12,388	865	137,876,266	6,367	607	84	195	5,481	31,325,539	5,908	....
Cumulative 1958	31,299	15,409	764	2,413	11,939	774	129,803,168	6,186	607	106	188	5,285	29,030,981	....	....

00 = 18: Wyo. 1, Okla. 5, Panhandle 2, N. M. 2, Dist. (1) 1, Dist. (2) 1, Dist. (4) 4, Ill. 2.

. . . and in Canada

	TOTAL WELLS						WILDCATS					
	Total	Oil	Gas	Day	Footage	Cum. 1959	Total	Oil	Gas	Dry	Footage	Cum. 1959
Western Canada	**181**	**108**	**34**	**39**	**864,125**	**1,643**	**35**	**7**	**6**	**22**	**187,438**	**465**
Alberta	117	66	25	26	608,114	988	20	2	4	14	122,197	253
Saskatchewan	52	38	4	10	209,227	562	11	4	1	6	46,629	156
Manitoba	4	3	0	1	7,151	27	1	0	0	1	1,258	6
British Columbia	8	1	5	2	39,633	62	3	1	1	1	17,354	46
N.W.T.	0	0	0	0	0	4	0	0	0	0	0	4
Ontario	16	1	4	11	24,770	154	..	..	..	..	.....	...

mond, SW NE NE 28-22n-9e. IP 46 BOPD, 10 BWPD, Arbuckle 2,674-79 ft., 2,665-70 ft. TD 2,801 ft.

Texas County: Phillips Petroleum Co. 1 Hitch "T," 21-2n-16eCM. IPF 14,287 M.c.f.d., 45.2°, Oswego 5,828-42 and 5,845-85 ft. TD 7,050 ft. New field.

WEST CENTRAL TEXAS

Coleman County: Youngblood & Youngblood and Dalco Oil Co. 1 Mrs. J. Hughes, 2 miles north of Silver Valley in northwest part of county, Sec. 34, Blk. 2, GH&H Sur. IPF 118 BOPD, 12/64-in. choke, Gray sand 3,493-99 ft., 42°, GOR 1780:1. TD 3,530 ft. New oil discovery.

Throckmorton County: Woodson Oil Co. 1-B E. Steadham, 3 miles southwest of Throckmorton in central part of county, S½ Sec. 248, BBB&C Sur. IPP 9 BOPD, plus 25% water, Mississippian open hole, top pay 4,922 ft. TD 4,934 ft. New oil discovery.

WYOMING

Natrona County: Skelly Oil Co. 1 Amy Tresner, SW NE SE 19-30n-81w. IPP 102 BOPD, 26 BWPD, Ervay Tongue (Phosphoria) discovery, new field. TD 3,378 ft. Tensleep.

(Continued on page 175)

Gas-Industry Growth Is Goal

. . . of Canadian Gas Association's promotion campaign.

N. E. Tanner, new association head, will direct program.

PROMOTION of Canada's natural-gas industry is due a big push from Nathan Eldon Tanner, new president of the Canadian Gas Association.

If the success that has marked Tanner's unusual and varied ventures in the oil industry and in other fields carries over to his new post, the association's hard-hitting promotional campaign is certain to succeed.

Tanner's many-sided career would delight a nonfiction writer. It's convincing evidence that fact often is stranger than fiction.

At one time or another Tanner has been a school teacher and principal, an owner and operator of a general store, a successful politician, a provincial minister of mines, a bishop, president of an oil-producing company, and president of a pipeline company.

Nathan E. Tanner
. . . teacher, politician, oil man.

Background . . . His life has a slight international flavor. He was born in the U. S. but was reared in Canada.

Tanner was born in Salt Lake City May 9, 1898. His parents moved to Canada while he was still an infant. They settled in Cardston, Alta., only a few miles north of the U. S. border.

Tanner attended elementary and secondary schools in Cardston, normal school at Calgary, and took summer courses at the University of Alberta and the University of Utah. His first teaching job was in Hillspring, 20 miles from Cardston. There he married Sara Isabelle Merrill. To augment his teaching income, Tanner bought and operated a general store in Hillspring.

He returned to Cardston in 1928 to become principal of the high school. In 1933 and 1934 he served as a member of the Cardston town council.

Also in 1934, he became a bishop of the Church of Jesus Christ of Latter Day Saints, Cardston ward. He served until 1937, and the next year became president of the church's Edmonton branch. Since 1953, he has been president of the Calgary Stake, Latter Day Saints Church.

Tanner resigned as principal of Cardston high school in 1935 to run for Alberta's legislative assembly as a candidate of the Social Credit party. Not only was he elected, but just a year later he was made speaker of the house.

Tanner moved from the legislative to the administrative branch of government in 1937 when he was appointed Alberta's minister of lands and mines. He held that office when the Canadian oil industry was transformed by the now historic discovery at Leduc.

It soon became apparent that new and modified regulations regarding leasing, exploration, drilling, and production would be needed. As Tanner himself puts it, "Much time, thought, and effort as well as cooperation on the part of industry were required to accomplish what was done."

He held the office of minister of lands and mines until 1949 when he became minister of lands and forest and also minister of mines and minerals.

Oil career . . . He left the Alberta government in September 1952 to become president of Merrill Petroleums, Ltd.

Though he was president of Merrill only from 1952 to 1954, they were 2 important years in the history of the company. During that time Merrill expanded its operations substantially through the acquisition of Sun-

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▶▶▶ Personals

T. H. Philpott, Olin Oil & Gas Corp., has been elected 1960 president of New Orleans Geological Society. He succeeds **Eugene A. Gibson,** Humble Oil & Refining Co. Other new officers are **McLain H. Foreman,** Atwater Cowan & Associates, vice president; **Leonard H. Limes,** Kerr-McGee Oil Industries, secretary; and **Norman H. Tabor,** The California Co., treasurer. **Leslie Bowling,** consultant, has been elected a director.

Emmett L. Colvin, assistant manager of Texas Eastern Transmission Corp.'s division 1, North Little Rock, Ark., has been named manager of division 3, West Chester, Pa. **Dewey C. Henderson,** assistant manager of division 4, Baytown, Tex., has moved up to Baytown division manager. **Kenneth W. Yoder,** division 1 engineer, will succeed Colvin as North Little Rock assistant division manager.

Thomas E. Sunderland, vice president, a director, and member of the executive committee of Standard Oil Co. (Ind.), has joined United Fruit Co. as president, chief executive officer, and a director. Sunderland had been with Indiana Standard and its affiliates since 1940.

Howard D. (Deep) Henderson, manager of production and supply for Trunkline Gas Co., and **Burton T. Mast,** chief engineer, have been appointed vice presidents of the company.

Celanese Chemical Co. has named four new vice presidents. They are **Henry K. Dice,** manager of chemical research and development, now vice president and technical director; **David D. Hecht,** manager of chemical product development, vice president, product development; **Robert H. Kampschulte,** general sales manager of the chemical division, vice president, sales; and **Ernest T. Lindsey,** manager of chemical manufacturing operations, now vice president, manufacturing.

R. A. Feagan, Jr., plant engineering supervisor for Pan American Petroleum Corp., has been named North Texas-New Mexico division gas superintendent. He succeeds **J. C. Conner,** who was recently given a special assignment with Standard Oil Co. (Ind.), the parent company.

ray's Canadian holdings. It was also then that oil was discovered in the Pembina area, where Merrill had extensive holdings.

In 1954 Tanner became president of Trans-Canada Pipe Lines, Ltd. He held that post until June 1957, when he was elected chairman. He resigned as chairman in December 1958, but has continued as a director of the gas transmission company.

While he was president and chairman of Trans-Canada, it grew from a newly formed company to the operator of the world's longest, large-diameter pipeline. It stretches nearly 2,300 miles and serves Canada from the Alberta border to Montreal.

Tanner has many other business interests in addition to Trans-Canada. He is a director of Toronto-Dominion Bank, Inland Cement Co., Ltd., Waterous Equipment, Ltd., Jenkins Groceteria, Ltd., National Trust Co., Consolidated Freightways, Inc., and Alberta Gas Trunk Line Co., Ltd.

He has served as provincial commissioner, Boys Scouts Association and is now a member of the Alberta Council. He is a member of the Calgary Chamber of Commerce, Toronto Board of Trade, and the Canadian Institute of Mining and Metallurgy.

An innate optimist, he sees a sound future for natural gas in Canada. "Nearly everyone agrees," he says, "that the future outlook for the natural-gas industry in Canada is bright." However, he adds, "Early and positive action on the part of the government to determine and make known its policy regarding the natural-gas industry and gas exports is most important."

Bill J. Langford, Dallas, has been elected vice president of Heritage Petroleum Corp. He will be in charge of production and field activities. Langford was recently named vice president of Frontier Drilling & Production Co., a subsidiary. He has been with Heritage for 2 years.

William R. Pearce, Bismarck, N. D., independent, has been elected president of North Dakota Oil and Gas Association. New vice presidents are **Robert L. Connell,** Sun Oil Co.; **Clay M. Murray,** Amerada Petroleum Corp.; **Hugh E. Palmer,** Cardinal Drilling Co.; and **William Sloan,** Ohio Oil Co. Other officers include **Clifford Jansonius,** Bismarck, secretary; **Allan Eastman,** Bismarck, executive director; and **A. A. Mayer,** Dakota National Bank, treasurer.

Robert B. Batten, assistant to the chief engineer of Michigan Consolidated Gas Co., has been appointed assistant chief engineer.

Richard N. Knoblock, district engineer for Texaco, Inc., has been transferred to Wichita from Salem, Ill.

C. E. Boone, vice president of Amerada Petroleum Corp., has been elected a director. Boone has been with Amerada since 1934.

Dr. Ralph E. Gilchrist, research engineer with Sinclair Research Laboratories, Inc., in Tulsa, has joined Phillips Petroleum Co. in Bartlesville, Okla., as research engineer in production research.

Donald K. Ballman, director of sales for Dow Chemical Co., and **C. B. Branch,** manager of overseas operations, have been elected vice presidents. Both are Dow directors.

George W. (Bill) Hoffman, field production superintendent with Frontier Refining Co. in Thermopolis, Wyo., has resigned to join Amerada Petroleum Corp. as petroleum exploitation engineer in Lafayette, La.

John B. Nunn, Mid-Continent area land manager for Sunset International Petroleum Corp., has resigned to become an independent operator in Denver. Nunn was manager of West Texas operations for Ashland Oil & Refining Co. before joining McRae Oil & Gas in 1957. He was vice president and a director of McRae before its merger with Sunset.

Robert W. Gerhard, director of the distribution economics coordination division in the supply and transportation department of Standard Oil Co. (Ind.), has been appointed director of economic research of Ste. Civile Amoco, Indiana Standard's foreign market study group in Paris. Gerhard will succeed **John W. Boatwright,** chief economist for Indiana Standard since 1956. Boatwright, who has been assigned to Ste. Civile Amoco for the past year, will retire January 1. In other changes, **Donald S. Warning** will become director of marketing research in a reorganization of the distribution economics department. He was formerly distribution economics department manager. **Howard A. Parker,** New York, assistant to the general manager of manufacturing of American Oil Co., an affiliate, has been appointed manager of coordination and supply planning in the supply and transportation department at Chicago.

▶▶▶ Personals

Alvin R. Winzeler, Canadian division exploration superintendent for Pan American Petroleum Corp., has been transferred to Houston as Texas-Louisiana Gulf Coast division exploration superintendent. He succeeds **J. C. Johnston,** whose appointment as manager of exploration in Tulsa was announced last week. **John C. Meeker,** Canadian division geologist, will succeed Winzeler as division exploration

WINZELER

MEEKER

superintendent. Other changes in the Canadian division include **Michael R. Waller,** Calgary district geologist, named division geologist, and **Howard W. Schwartz,** Calgary area geologist, who will succeed Waller. In the Texas-Louisiana Gulf Coast division, **J. C. McCarthy,** former assistant division production superintendent in Casper, Wyo., has been named assistant division superintendent. He succeeds **George C. Wight,** who has moved to Pan American International Oil Co., in New York. **C. A. Brooke, Jr.,** district exploration superintendent in New Orleans, has been appointed division geologist in Houston. He succeeds **R. S. Tremaine,** who was recently named geological research director in the Tulsa research center. **Phil H. Garrison,** geophysical supervisor in Tulsa, has been named to succeed Brooke as New Orleans district exploration superintendent. Also, **John W. Phenicie,** Casper division engineer, has moved up to assistant Rocky Mountain division production superintendent, succeeding McCarthy. **Donald H. Falkingham,** Cody, Wyo., district engineer, succeeds Phenicie in Casper. **R. B. Giles,** senior petroleum engineer in Casper, moves to Cody to succeed Falkingham.

Tom G. Medders Jr., independent operator of Wichita Falls, Tex., has been elected chairman of the State Action Committee, coordinating unit of statewide and regional independent producer groups. Meders succeeds **Harry Jones** of Kilgore, Tex., president of the Texas Independent Producers and Royalty Owners Association.

▶▶▶ Personals

Rexford S. Blazer, chairman of Ashland Oil & Refining Co., has been elected president of National Petroleum Association. Blazer succeeds **Guy B. Hunter,** chairman of Quaker State Oil Refining Co. Other new officers are **John E. Selden,** South Penn Oil Co., vice president, and **L. E. Kincannon,** Rock Island Refining Corp., second vice president. New trustees include **Marc Braeckel,** Sinclair Refining Co.; **F. O. Koontz,** Quaker State Oil Refining Co.; **Richard Sauer,** Standard Oil Co. (Ohio); **W. E. Smith,** Standard Oil Co. (Ky.); and **F. Kemmis Cadwell,** Union Oil Co. of California.

BLAZER

L. Thain Leonard has resigned as president of Pano Tech Exploration Corp., Houston independent producing firm. He will continue as a director. **Harold Geis,** Houston consultant and a director of Pano Tech, has been named acting president. Leonard was one of the founders of the company in 1954.

Don M. Brown has been elected assistant secretary, board of directors, Aramco Overseas Co. He formerly was acting executive secretary of the executive management council, and acting assistant secretary, Aramco.

J. R. Pace, formerly division reservoir engineer in eastern Venezuela for Creole Petroleum Corp., has joined Wireline Engineers, S. A., of Venezuela as vice president and general manager. He will headquarter in Las Morochas.

Dr. Jose Antonio Giacopini Zarraga has been appointed a director of Cia. Shell de Venezuela. He will continue as assistant to the president.

John G. Winger, petroleum economist with Chase Manhattan Bank and author of the bank's monthly review, "The Petroleum Situation," has been appointed a vice president in the petroleum department.

Charles B. Dale, chemical engineer in Whiting, Ind., for Standard Oil Co. (Ind.), has joined the staff of the U. S. Navy propellant plant, Indian Head Md., as project engineer.

George J. Rozman, formerly research director for Valvoline Oil Co. in Freedom, Pa., has been transferred to Ashland, Ky., where he will join the research and development department of Ashland Oil & Refining Co. as research supervisor. Valvoline is a subsidiary of Ashland.

Edwin J. Hoffman, technical foreman on the coking unit at Tidewater Oil Co.'s Delaware City, Del., refinery, has been named supervisor of the crude-processing area. In other changes, **William J. Doyle,** technical foreman of the crude unit, has been named unit technical foreman of the alkylation-polymerization area, and **George M. Rose,** group leader in the technology department, will be unit technical foreman of the cracking area. **Laurance A. Gleason,** technical foreman of alkylation and polymerization units, becomes unit technical foreman in the utilities and sulfur recovery area. **Charles W. McCloud,** former technical foreman in the cracking area, has moved to the coking area as unit technical foreman. **Clarence E. Slater,** coking area, has been appointed senior engineer in the engineering department.

Carl Fredrick Harpke, production engineer with Pan American Petroleum Corp., has been transferred to Kimball, Neb., from Brush, Colo.

Charles A. Brasier, engineer with Carter Oil Co., has been transferred to Jackson, Miss., from Magnolia, Ark.

C. A. Blanchard, assistant to the division superintendent of Rowan Drilling Co.'s Gulf Coast division in New Orleans, has been transferred to Houston to head Rowan's new office there. Blanchard has been with Rowan since 1947 in Odessa, Tex., Fort Worth, and New Orleans. He had been assistant to the Gulf Coast division superintendent since 1956.

John W. Peel, Jr., formerly Tidewater Oil Co.'s area sales supervisor in San Diego, Calif., has been named government sales supervisor in the western division. He will headquarter in Los Angeles.

Robert W. Johnston, formerly engineer with Sohio Petroleum Co. in Casper, Wyo., has joined Belco Petroleum Co. in Big Piney, Wyo., as engineer.

Herbert F. Defenbaugh, Sinclair Oil & Gas Co.'s division production superintendent in Midland, Tex., has been elected vice president for production. He will move to Sinclair's Tulsa headquarters October 1. Defenbaugh succeeds **F. H. Rhees,** vice president and a director, who has been promoted to operations coordinator. **O. G. Simpson,** Tulsa, executive assistant to Rhees, will succeed Defenbaugh in Midland.

DEFENBAUGH

RHEES

John Pedry, area geologist for Pan American Petroleum Corp., and **Bill Hurley,** geologist, have been transferred to Bismarck, N. D., from Casper, Wyo.

Jerry B. Allen, field foreman in New Town, N. D., for Pan American Petroleum Corp., has been named drilling foreman in Craig, Colo.

J. D. Driskill, Jr., has joined Bart De Laat & Associates, Houston consulting firm, as an associate engineer. Driskill was with Gulf Oil Corp. at one time and more recently has been associated with independent operators.

Jerry M. Ewers, formerly vice president and geologist with Alex W. McCoy Associates, Inc., Tulsa, has joined Plymouth Oil Co. as regional geologist in Denver. Ewers was with Phillips Petroleum Co. before joining McCoy Associates.

Henry E. Thomas, area foreman for Sun Oil Co. in Cody, Wyo., has been promoted to area superintendent in Silt, Colo.

Don R. Greenwalt, field engineer with Tidewater Oil Co., has been transferred to Victoria, Tex., from Robinson, Ill.

Alan Davis, production engineer with Tidewater Oil Co., has been transferred to Ventura, Calif., from Los Nietos, Calif.

Frank M. Cheatham, petroleum engineer with Frankfort Oil Co., has been transferred to Dallas from Lafayette, La.

James A. Bailey, Penrod Drilling Co. tool pusher, has been transferred to Newtown, N. D., from Ray, N. D.

Fred M. Cox, formerly Shell Oil Co. geologist in Baton Rouge, La., has opened consulting offices in Denver.

James Boyd Smith, formerly sales representative in American Cyanamid Co.'s refinery chemicals department, Houston, has been appointed manager of sales development for refinery chemicals.

Lawrence C. Martin, supervisory engineer with Mobil Oil Co. at Hawarden, Iowa, has been named district gauger for Mobil at Peabody, Kans.

Don L. Hall, formerly with Hill & Hill and Sinclair Oil & Gas Co., has joined H. J. Gruy & Associates, Inc., Dallas, as geologist. Hall is a graduate of the University of Texas.

THOMPSON

Lewis M. Thompson, manager of Cosden Petroleum Corp.'s production department, has been elected vice president in charge of the production department. Cosden has also named **Lowell E. Ullery,** vice president of Chase Manhattan Bank, a director. Thompson joined Cosden in 1953 as drilling engineer. He was named production department manager in 1956. He is a graduate of Texas Technological College.

J. A. Golasinki, superintendent of operations in Shell Oil Co.'s Houston area gas department, has been promoted to manager of the area gas department.

R. G. Simonton has joined Atlantic Refining Co. as head of the drilling-production group for Canadian operations. He will headquarter in Edmonton.

R. C. Curtis, president of Jersey Production Research Co., and **Harry A. Jarvis,** executive vice president of Creole Petroleum Corp., have been elected directors of Esso Research & Engineering Co. Curtis was executive vice president of Jersey Production Research before being named president last month. Jarvis has been Creole executive vice president since 1954. Both have been with affiliates of Standard Oil Co. (N. J.) since the 1930's.

Jack Clare, formerly geologist with Superior Oil Co. in Bakersfield, Calif., and Billings, Mont., has opened consulting offices in Bakersfield.

C. E. Pitcher, foreman for Ohio Oil Co. at Lance Creek, Wyo., has been transferred to Cody, Wyo., in the same position.

Grady G. Garrison, administrative assistant to the district manager of Monsanto Chemical Co.'s Lion Oil division in El Dorado, Ark., has been appointed assistant manager there.

Earl F. Armstrong, engineer with Phillips Petroleum Co. in Borger, Tex., has been named geologist in Billings, Mont.

Malcolm Kutner, formerly of Lubbock, Tex., has joined Chambers & Kennedy, Midland, Tex., producing firm. He will be in charge of the company's new Houston office.

Robert L. Kendig, Ponca City, Okla., has been promoted to research engineer in Continental Oil Co.'s production research division.

▶▶▶ Personals

Robert M. Woolfolk, Jr., assistant manager of manufacturing for Texas Gas Corp., has moved up to manager of manufacturing. Woolfolk joined Texas Gas in 1957 as chief engineer. He was with The California Co. as Gulf Coast division engineer before that time. He is a graduate of Tulane University.

Dr. Fred W. Burtch has joined Gulf Research & Development Co., Pittsburgh, as project chemist in the well stimulation section, production engineering division.

Carl A. Ballinger, formerly division operations specialist in Ohio Oil Co.'s marketing sales division, has been appointed senior planning associate, forward planning division. Ballinger has been with Ohio since 1929.

▶▶▶ Deaths

Frederick S. Mallette, 53, executive secretary of American Society of Mechanical Engineers' air pollution controls committee, died recently at his home in Riverside, Conn. He had been with ASME since 1952.

Leigh A. Brown, 71, former president of National Fuel Gas Co. of New York, died September 12 at his home in New York.

Horace B. Horton, 73, chairman of Chicago Bridge & Iron Co., died September 17 in Chicago. Horton had been chairman of the company, which was founded by his father, since 1956. He was president before that time. He joined the firm in 1907 after graduation from the University of Chicago.

James H. Gwin, Oklahoma City independent operator, died September 13 in Oklahoma City. Gwin had been active in Texas, Oklahoma, Louisiana, Illinois, Indiana, and Mississippi during his career.

Tom R. Carter, 32, district manager and geologist for Honolulu Oil Corp. in Farmington, N. M., died September 15 in an automobile accident near Cortez, Colo.

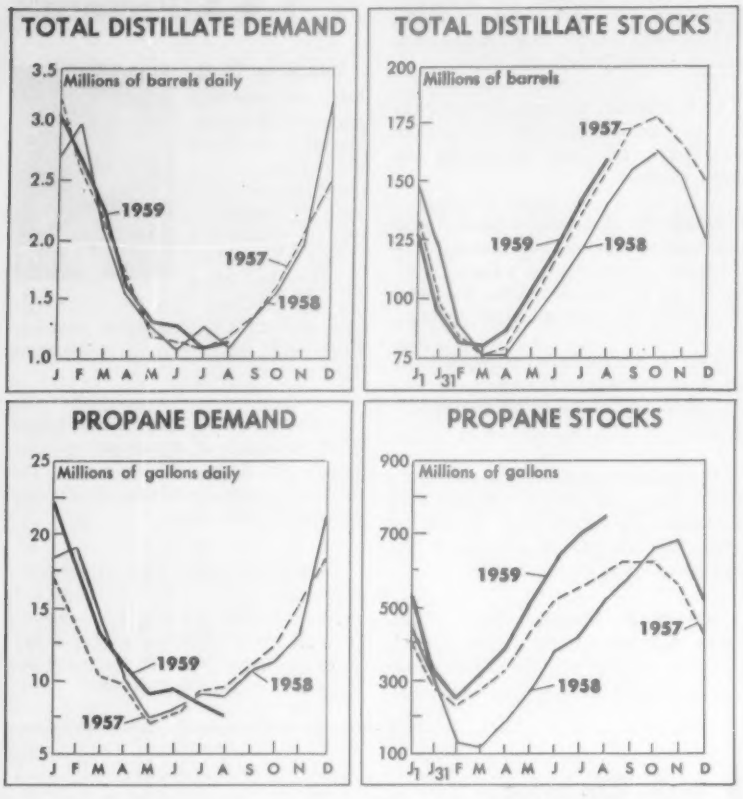
Charles Frederick Brown, 56, former owner of Brown Service Co., died September 16 at his home in Rio Vista, Calif.

A. O. Dry, Jr., 36, assistant drilling superintendent of Sharp Drilling Co., Midland, Tex., died September 18 in a Galveston, Tex., hospital from burns suffered during an oil well blowout and fire last month near Midland.

Frank Clarke (Pat) Dougherty, 79, pioneer in development of California's Kettleman Hills field, died September 19 at his home in La Jolla, Calif. Dougherty was also active in Canadian oil developments at one time.

Dr. E. E. Rosaire, 62, retired partner in Geo-Chemical Surveys, Inc., and pioneer geophysicist, died September 21 at his Dallas home after a heart attack. In 1925 Rosaire was the first man to do geophysical field work for Geophysical Research Corp., subsidiary of Amerada Petroleum Corp. He was a charter member of the Society of Exploration Geophysicists.

Benjamin F. Saye, 78, retired general counsel for Halliburton Oil Well Cementing Co., died September 21 in Duncan, Okla.



Low demand, high stocks, excess production dim distillate outlook

BY JOHN HYDEN

DISTILLATE DEMAND for the first 8 months of 1959 has followed closely the same course as 1957 and 1958. There were no major increases during the period. The August demand figure of 1.14 million barrels daily was 40,000 bbl. daily under August figures for 1957. Distillate production has increased even though demand hasn't and the result is an unwelcome excessive stock situation.

The average desirable inventory figure for distillate in October 1959, as reported to the Texas Railroad Commission, was 157.6 million barrels. But distillate stocks have been higher than that since the last week in August and if they continue to increase as they have in the past August-October periods, then we can expect a new all-time peak of approximately 185 million barrels for October. This is 10 million barrels over the highest reported desirable inventory figure and about 17 million barrels over the average reported figure.

Distillate stocks have been high since March of this year after being a little low for the first 3 months. The 1959 figures for the March-August period have exceeded 1958 figures by a wide margin and have been consistently higher than the unusually high stocks in 1957. The latest distillate stock figure for August is 162 million barrels compared to 140 million barrels in 1958 and 159 million barrels in 1957.

Unless there is some extreme winter weather, a few refiners might have to move some of their excess stock at a reduction and the resultant distillate sales activities could cut the bottom out of the market—a delayed and costly remedy for a problem that has been apparent for several months.

Propane demand has varied from the usual seasonal pattern. After following the normal seasonal variations for the first 6 months, propane demand has assumed a downward course in July and August instead of the usual upturn. The July figure of 8 million gallons daily was 900,000 gal. daily under July 1958 and 1.1 million gallons daily under July 1957. August demand dropped even further to 7.3 million gallons daily. This was 1.5 million gallons daily under August 1958 and 2.3 million gallons daily below the same period in 1957.

Propane stocks have been high all year and have been getting relatively higher in the last 4 months. July stocks in 1959 increased to 700 million gallons. This was 273 million gallons over July 1958—an increase of 64%.

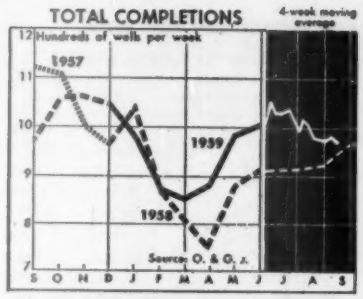
A new record was established for propane stocks in August this year. The stock figure soared to 756 million gallons, 239 million above the 1958 figure or an increase of 46%.

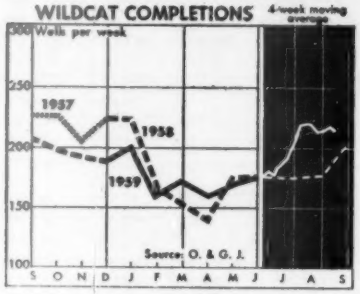
Past August-October increases indicate that this year the October peak will be around 785 million gallons. The propane stock excess is even more pronounced than distillate stock excess because, in addition to the increased production, propane is losing a growing share of its market to butane, and a larger per cent of propane stock is showing up in storage away from the market instead of at the distributors.

Low demand figures, high stock figures, and increasing production figures form a dim outlook for distillate.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,827,190	DOWN	4,300	DOWN	278,235
Crude stocks	249,155,000	DOWN	2,793,000	UP	8,439,000
Completions	885	DOWN	98	DOWN	178
Refinery runs	7,994,000	DOWN	187,000	UP	390,000
Gasoline stocks	180,782,000	DOWN	2,709,000	UP	7,624,000
Kerosine stocks	32,486,000	DOWN	301,000	UP	2,475,000
Distillate stocks	170,253,000	UP	1,675,000	UP	20,792,000
Residual stocks	58,167,000	DOWN	611,000	DOWN	10,726,000
Four-product stocks	441,688,000	DOWN	1,946,000	UP	20,165,000
Total imports	1,391,900	DOWN	281,600	DOWN	68,400





Active Rotary Rigs

	9-21-59	9-14-59	9-22-58
Alabama	8	9	6
Arkansas	17	21	25
Arizona	1	2	2
California	89	102	75
Land	85	97	(*)
Offshore	4	5	(*)
Colorado	61	§60	38
Florida	2	1	1
Land	2	1	1
Offshore	0	0	0
Illinois	48	39	53
Indiana	7	11	8
Iowa	2	2	3
Kansas	133	130	147
Kentucky	10	8	10
Louisiana	329	320	311
North	36	35	35
S. Inland waters	123	129	(†)
S. Land	112	106	238
Offshore	58	50	38
Maryland	0	0	0
Michigan	33	34	12
Mississippi	77	70	45
Missouri	0	0	1
Montana	26	29	20
Nebraska	25	25	26
Nevada	1	2	0
New Mexico	112	120	100
New York	0	0	2
North Dakota	26	21	34
Ohio	5	5	1
Oklahoma	223	218	209
Oregon	0	0	0
Pennsylvania	8	11	9
South Dakota	8	7	3
Texas	754	722	669
S. Inland waters	6	6	(†)
S. Land	192	187	129
Offshore	0	0	1
North-East	166	164	(*)
West Central	247	237	(*)
West	143	128	(*)
Utah	30	§24	29
Washington	2	2	1
West Virginia	5	5	3
Wyoming	90	88	66
Total U. S.	2,132	2,088	1,909
Western Canada	178	157	146
Eastern Canada	1	1	4
Grand total	2,311	2,246	2,059

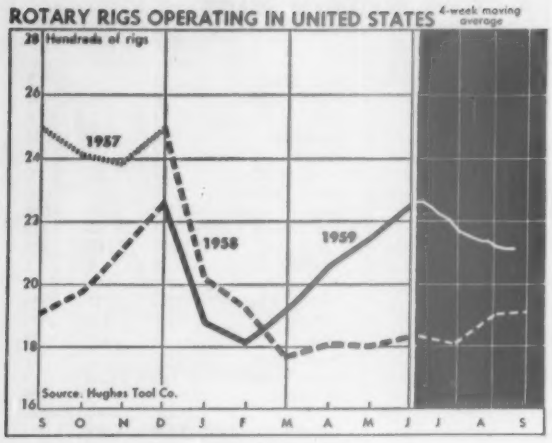
Hughes Tool Co. report. *Comparisons not available due to change in method of reporting. †Included in South-Land. §Revised.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED SEPTEMBER 19, 1959

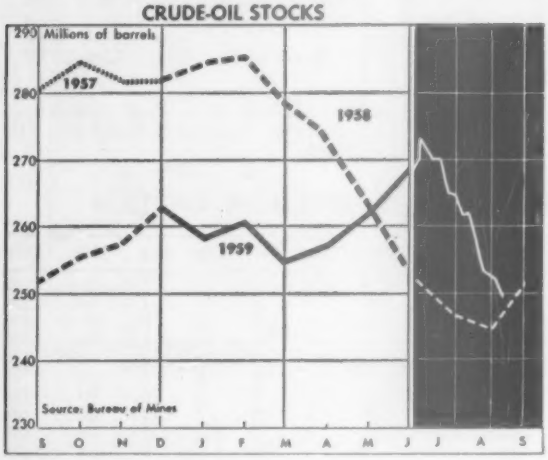
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1959	1958	Total	Crude	Cond.	Gas	Dry	1959	1958
Alabama	5	2	0	0	3	0	44,276	70	55	3	0	0	0	3	20	20
Arkansas	12	4	0	0	8	0	39,490	590	549	4	0	0	0	4	104	116
California	33	17	0	2	12	2	205,539	1,083	1,147	11	0	0	2	9	277	274
Colorado	11	2	0	0	9	0	67,032	255	587	7	0	0	0	7	332	340
Illinois	44	25	0	0	18	1	97,520	1,613	1,584	4	1	0	0	3	274	321
Indiana	12	4	0	0	8	0	14,238	588	550	3	0	0	0	3	198	196
Kansas	81	26	0	4	50	1	301,015	2,888	2,698	35	4	0	1	30	714	571
Kentucky	64	21	0	6	37	0	68,830	1,750	843	19	0	0	1	18	188	109
Louisiana	72	28	5	6	33	0	595,098	2,647	2,472	13	1	0	1	11	359	359
North	30	7	0	5	18	0	146,878	1,015	905	8	1	0	1	6	156	149
South	24	11	1	1	11	0	227,078	1,342	1,246	5	0	0	0	5	189	188
Offshore	18	10	4	0	4	0	221,142	290	321	0	0	0	0	0	14	22
Michigan	8	4	0	0	4	0	26,820	456	298	1	0	0	0	1	116	97
Mississippi	16	10	0	0	6	0	147,416	450	277	4	0	0	0	4	203	126
Montana	4	2	0	0	2	0	21,864	230	245	1	0	0	0	1	72	99
Nebraska	16	4	0	1	11	0	99,178	634	504	6	1	0	0	5	265	237
New Mexico	32	22	0	3	5	2	120,667	1,470	1,411	2	0	0	0	2	170	194
West	11	5	0	3	1	2	41,659	665	684	0	0	0	0	0	45	81
East	21	17	0	0	4	0	79,008	805	727	2	0	0	0	2	125	113
New York	0	0	0	0	0	0	0	195	401	0	0	0	0	0	18	37
North Dakota	4	3	0	0	1	0	28,316	344	332	0	0	0	0	0	65	108
Ohio	23	8	0	5	10	0	47,254	713	742	0	0	0	0	0	23	12
Oklahoma	51	23	1	1	25	1	178,047	4,061	4,604	10	1	1	0	8	618	630
Pennsylvania	57	18	0	24	4	11	162,920	392	438	1	0	0	0	1	10	14
Texas	297	166	12	9	104	6	1,293,306	13,593	12,930	57	0	0	0	57	2,566	2,666
Dist. 1	11	4	0	0	7	0	18,609	780	704	5	0	0	0	5	226	284
Dist. 2	9	4	0	1	4	0	67,495	567	547	3	0	0	0	3	171	145
Dist. 3	13	4	2	0	7	0	100,166	859	932	4	0	0	0	4	177	211
Dist. 4	27	6	7	2	12	0	128,311	966	864	8	0	0	0	8	239	257
East	24	14	1	0	8	1	77,159	884	879	4	0	0	0	4	172	245
Dist. 7-B	31	17	0	1	13	0	98,333	1,849	1,757	7	0	0	0	7	493	496
West	107	79	0	1	27	0	569,616	4,189	3,707	15	0	0	0	15	579	523
Dist. 9	61	30	1	1	24	5	160,587	2,562	2,609	11	0	0	1	11	434	422
Dist. 10	14	8	1	3	2	0	73,030	937	931	0	0	0	0	0	75	77
Utah	1	1	0	0	0	0	5,623	222	279	0	0	0	0	0	58	61
West Virginia	22	0	0	16	3	3	56,434	561	515	3	0	0	2	1	23	12
Wyoming	16	4	0	1	11	0	84,630	708	548	7	0	0	0	7	243	164
Misc. (Wash., Ariz., S.D.)	4	2	0	0	2	0	26,122	102	69	2	0	0	0	2	67	59
Total U. S.	885	396	18	78	366	27	3,731,635	35,915	34,078	193	8	1	7	177	6,983	6,816
Prev. week	983	461	26	92	383	21	4,293,668	.....	.....	234	18	3	11	202	.....	.....
Cum. 1959	35,915	18,013	875	2,642	13,458	927	149,487,410	.....	.....	6,983	649	90	224	6,020	.....	.....
Cum. 1958	34,078	16,684	829	2,609	13,066	890	141,049,481	.....	.....	6,816	671	118	195	5,832	.....	.....
Western Canada	30	15	0	3	12	0	129,472	1,749	1,757	9	1	0	0	8	491	475
Ontario	16	3	0	6	7	0	23,135	170	.....	.....	.....	.....	.....	.....	.....	.....

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*
(Thousands of barrels)

	9-12-59	9-5-59	9-13-58
Pennsylvanian	2,691	2,732	2,853
Other Appalachian	2,033	1,980	1,379
Illinois, Indiana, Michigan	9,455	9,620	10,098
Nebraska and North Dakota	2,668	2,471	2,230
Kansas	10,003	9,867	9,289
Oklahoma	14,769	15,312	15,821
Arkansas	2,001	2,218	1,872
Louisiana	17,768	18,666	15,001
North	3,383	3,366	2,722
South	14,385	15,300	12,279
Mississippi, Alabama, Florida	2,604	2,467	2,765
New Mexico	7,697	8,203	8,005
Texas	106,254	106,817	100,686
East Texas	8,758	8,476	7,668
West Texas	48,471	49,739	49,982
Texas Gulf	18,205	18,537	17,988
Other Texas	30,820	30,065	25,048
Wyoming	15,923	16,122	13,104
Other Rocky Mountain	9,366	9,767	9,127
California	30,219	30,720	35,047
Foreign	†15,704	14,986	13,439
Total	249,155	251,948	240,716

*Bureau of Mines. †Includes 4,333,000 bbl. in California.

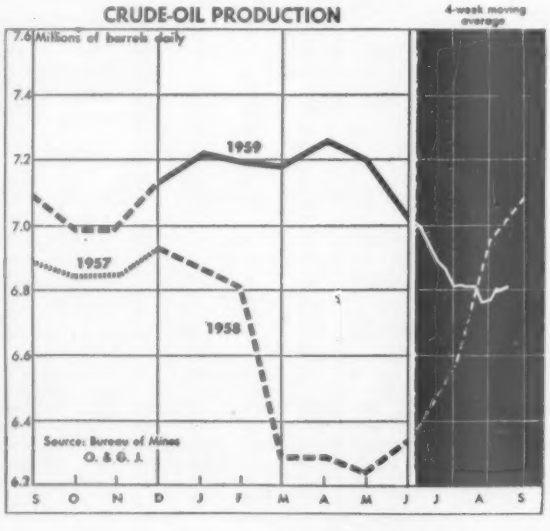
DAILY AVERAGE PRODUCTION FOR WEEK

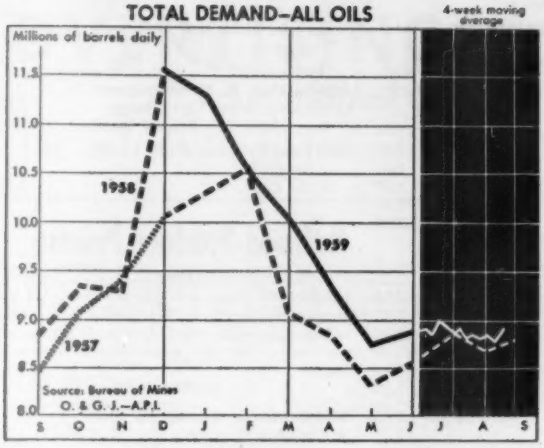
	September 19, 1959			Sept. 12
	Crude oil	Lease condensate	Total	total
Alabama	15,500	.....	15,500	15,400
Arkansas	46,000	300	46,300	47,300
California	840,200	.....	840,200	843,200
Colorado	126,900	.....	126,900	126,000
Eastern	40,300	.....	40,300	40,900
Florida	1,200	.....	1,200	1,200
Illinois	216,800	.....	216,800	214,900
Indiana	33,100	.....	33,100	33,000
Kansas	†315,040	.....	†315,040	†312,490
Kentucky	81,400	.....	81,400	89,500
Louisiana	899,000	98,850	997,850	999,750
North	108,000	5,100	113,100	115,000
South	791,000	93,750	884,750	884,750
Michigan	29,600	.....	29,600	29,900
Mississippi	137,800	3,770	141,570	141,570
Montana	81,900	.....	81,900	80,800
Nebraska	65,100	.....	65,100	64,300
Nevada	100	.....	100	100
New Mexico	286,000	4,900	290,900	290,900
North Dakota	48,700	.....	48,700	40,100
Oklahoma	†498,600	.....	†498,600	†502,650
Texas	2,430,000	70,020	2,500,020	2,500,020
Dist. 1	42,000	2,000	44,000	44,000
Dist. 2	103,000	7,600	110,600	110,600
Dist. 3	315,000	35,800	350,800	350,800
Dist. 4	170,000	8,200	178,200	178,200
Dist. 5	28,500	300	28,800	28,800
Dist. 6	105,000	6,200	111,200	111,200
East Texas field	132,500	.....	132,500	132,500
Dist. 7-B	132,500	100	132,600	132,600
Dist. 7-C	115,000	3,020	118,020	118,020
Dist. 8	975,000	4,200	979,200	979,200
Dist. 9	202,000	1,600	203,600	203,600
Dist. 10	109,500	1,000	110,500	110,500
Utah	111,000	.....	111,000	111,900
Wyoming	344,800	.....	344,800	345,300
Others	‡310	.....	‡310	‡310
Total U. S.	6,649,350	177,840	6,827,190	6,831,490
Change from prev. week, down			4,300	.....
Canada	†575,000	.....	†575,000	†476,400

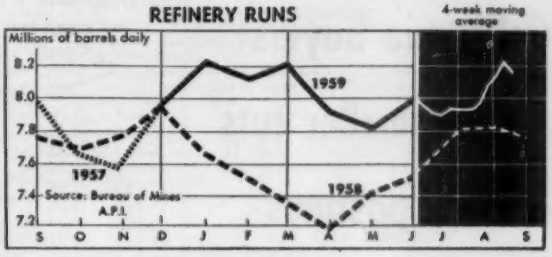
Total U. S. prod., January 1-September 19 .... 1,853,229,630 bbl.
Same period last year (crude plus cond.) .... *1,723,624,670 bbl.

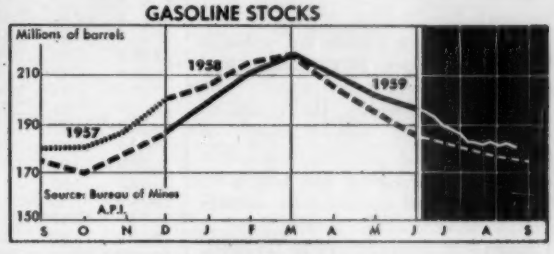
*Includes 41,240,920 bbl. condensate. †Week ended previous Monday. ‡Arizona, South Dakota, and Washington.

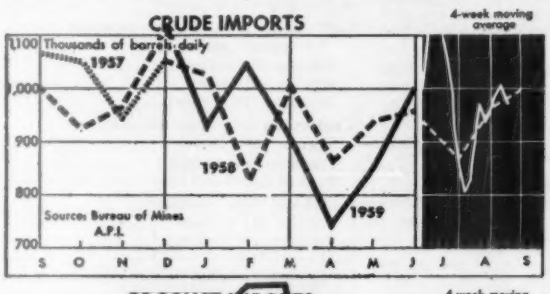
CRUDE-OIL PRODUCTION

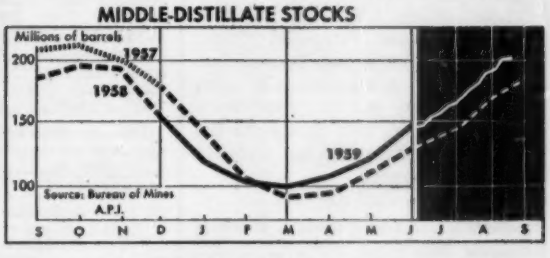


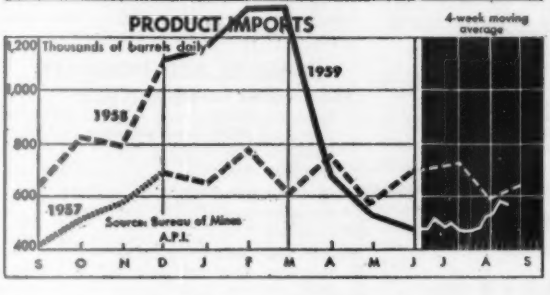


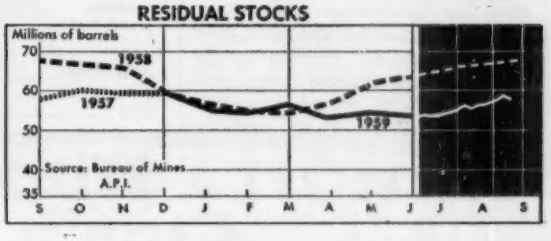












API REFINERY REPORT—SEPTEMBER 18, 1959

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, September 1958 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,060	533.2	0	344.9	137.0	43,973	13,492	66,942	11,941	1,135	529.4	31.3	313.1	202.0
Appalachian:														
District 1	98	42.9	2.6	23.3	6.6	5,606	669	4,286	381	103	44.6	4.6	21.9	6.8
District 2	91	51.3	5.6	17.7	5.9	2,631	531	1,721	462	96	51.3	5.4	20.7	6.8
Ind., Ill., Ky.	1,445	780.6	64.4	304.0	149.3	32,091	7,748	28,516	6,126	1,387	739.5	59.5	305.2	128.7
Minn., Wis., Dak.	107	51.1	1.4	27.7	12.1	6,465	1,372	8,161	438	76	31.3	1.7	21.8	8.6
Okla., Kans., Mo.	744	431.1	3.1	188.6	27.9	17,178	1,515	12,196	859	704	401.2	12.3	171.4	21.4
Inland Texas	294	229.9	8.0	57.3	23.0	7,264	546	2,132	2,214	270	201.9	11.2	46.8	22.1
Texas Gulf Coast	1,866	941.6	82.6	482.0	150.1	20,998	3,345	18,990	6,519	1,798	910.1	90.4	470.2	197.9
La. Gulf Coast	717	394.3	73.7	108.7	40.7	8,991	1,813	7,059	1,414	665	383.5	53.5	158.0	46.8
N. La. and Ark.	71	39.1	4.3	11.3	4.6	4,300	637	1,998	205	86	36.8	5.8	20.8	6.6
Rocky Mountain:														
New Mexico	22	16.4	0.7	3.7	2.4	767	40	158	57	25	13.1	0.5	4.8	2.4
Other Rky. Mt.	301	146.1	4.3	58.1	32.6	4,395	379	3,073	1,262	285	130.0	5.6	58.3	30.0
West Coast	1,178	512.7	8.9	143.6	276.7	26,123	399	15,021	26,289	1,133	504.9	3.0	170.5	293.1
Sept. 18, 1959	7,994	4,170.3	259.6	1,760.9	868.9	180,782	32,486	170,253	58,167	7,763	3,977.6	284.8	1,783.5	973.2
Sept. 11, 1959	8,181	4,212.9	311.4	1,705.4	871.1	183,491	32,787	168,578	58,778	.....	.....	.....	.....	.....
Sept. 19, 1958	7,604	4,001.4	285.9	1,758.6	985.1	173,158	30,011	149,461	68,893	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

California buyers prefer smaller cuts in new postings

A NEW price picture for crude is beginning to form in California and the Four Corners area.

Buyers apparently are going to settle upon the new postings of Standard Oil Co. of California rather than those of Union Oil Co. California Standard posted cuts averaging 5 to 25 cents a barrel while Union's cuts averaged 10 to 50 cents.

Those joining California Standard now are General Petroleum Corp., Richfield Oil Corp., and Texaco, Inc.

Meanwhile, Shell Oil Co. met Union's 15-cent cut in crude from the Four Corners area moving to the West Coast. Crude moving eastward so far is unchanged.

Products . . . The products markets remained steady last week.

Gasoline demand was fairly firm. Gulf Coast prices for distillates were up ⅛ cent and for kerosine up ¼ cent, but the market still lacked real strength. Humble started importing residual from Aruba and will continue to import 8,200 bbl. daily through October to meet requirements.

The API refining report carried good news on runs and gasoline production, but production of distillate was still up.

Crude runs during the week dropped from 8,181,000 bbl. daily to 7,994,000 bbl. daily while gasoline production was off from 4,212,900 bbl. daily to 4,170,300 bbl. daily. Gasoline stocks also dropped from 183,491,000 bbl. to 180,782,000 bbl.

Demand . . . The IPAA in its monthly supply and demand outlook predicted market for domestic crude should hit 7,250,000 bbl. daily by end of year. This is up 450,000 bbl. daily from current output.

Total petroleum supply will average 9,800,000 bbl. daily with imports averaging 1,700,000 and natural gas liquids about 850,000 bbl. daily. This is about same supply level as existed last year. A 200,000-bbl.-daily drop in imports will provide room for the domestic crude increase.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill§ Calif.	Oklahoma	Gulf Coast Tex.*	West Tex.† N.M. (sour)	Wyo.
14-14.9	$1.76	....	....	....	....
15-15.9	1.84	....	....	....	$1.81
16-16.9	1.92	....	....	....	1.86
17-17.9	2.00	....	....	....	1.91
18-18.9	2.08	....	....	....	1.96
19-19.9	2.16	....	....	....	2.01
20-20.9	2.24	$2.49	....	$2.35	2.06
21-21.9	2.32	2.52	....	2.38	2.11
22-22.9	2.39	2.55	....	2.41	2.16
23-23.9	2.46	2.58	$3.44	2.44	2.21
24-24.9	2.53	2.61	3.46	2.47	2.26
25-25.9	2.60	2.64	3.48	2.50	2.31
26-26.9	2.67	2.67	3.50	2.53	2.36
27-27.9	2.74	2.70	3.52	2.56	2.49
28-28.9	2.81	2.73	3.54	2.59	2.54
29-29.9	2.87	2.76	3.56	2.62	2.59
30-30.9	2.93	2.79	....	2.65	2.63
31-31.9	3.00	2.82	....	2.68	2.67
32-32.9	3.06	2.85	....	2.71	2.71
33-33.9	3.12	2.88	....	2.74	2.75
34-34.9	3.17	2.91	....	2.77	2.79
35-35.9	3.22	2.94	....	2.80	2.83
36-36.9	3.27	2.97	....	2.83	2.87
37-37.9	3.31	2.99	....	2.86	2.89
38-38.9	....	3.01	....	2.89	2.91
39-39.9	....	3.03	....	2.92	2.93
40-40.9	....	3.05	....	2.95	2.95

*Low cold test crude. †Sour.

Effective dates of broad changes: California, 9-11-59; East of California, January 3-10, 1957; Pennsylvania Grade 9-12-59.

§Union Oil Co. of California posting up to 25c less per barrel.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.40
Middle District	4.22
Southwest Pennsylvania	3.95
West Virginia	3.77
Buckeye Grade	3.62
Illinois Basin	**3.00**

FOREIGN

Canada:	
Leduc-Woodbend	2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38
Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.34
San Joaquin, 41°-41.9°, Puerto La Cruz	3.08-3.10
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes f.o.b. lifting port):	
Arabian, about 34°, Ras Tanura	$1.89
Iranian, 34.0°-34.9°, Bandar Masur	1.86
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05
Middle East, E. Mediterranean:	
Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias	2.29
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.57

Refined-Product Prices

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
★ Regular (91 octane)	11.25-11.75
★ Premium (99 octane)	14.00-14.50
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.75
Regular (92 octane)	11.00
Premium (98 octane)	12.25
California (rack) (Los Angeles):	
Regular (88 octane)	11.65-12.25
Premium (94 octane)	12.65-13.25
Premium (100 octane)	14.15-14.50
Caribbean area (cargoes):	
Regular (87 octane)	10.375
Premium (97 octane)	12.00

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.00-9.50
Diesel oil (58 d.i. and above)	8.75-9.25
Distillate No. 1	8.75-9.25
Distillate No. 2	8.00-8.50
Gulf Coast (cargoes):	
★ Kerosine 41-43	8.625
★ Distillate No. 2	8.125
New York Harbor (barges):	
Kerosine 41-43	9.60
Distillate No. 2	9.10
Diesel fuel, 48-52 d.i.	9.40
Caribbean area (cargoes):	
Distillate No. 2	8.125

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.60-1.70
Gulf Coast (cargoes):	
Bunker C fuel	$2.00
New York Harbor (barges):	
Bunker C fuel	$2.37-2.47
Caribbean (cargoes):	
Bunker C	$2.00
California (rack):	
Bunker C fuel, Los Angeles	$2.15

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

Carib.-Montreal, clean (ATRS —55%)	$1.82
★ Carib.-USNH, dirty (ATRS —55%)	1.24
★ PG-Durban, dirty (Scale —57.5%) (13s. 3d.)	1.86

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FOR SALE EQUIPMENT

WALKER-NEER S-31 Spudder, complete with truck, tools, and equipment. Top condition. $10,000.00. Yost Oil Company, Box 31, Colorado City, Texas. Phone RA 8-3658.

FIGURE 1585 GOULDS Triplex pressure pump. Clean condition. 3 barrels minute 1,000 pound pressure. $1250.00. Lyytinen, Nowata, Oklahoma.

AAA PIPE. The Cherokee Co., George Bauer, 2601 E. 15th, WE 9-3020, Tulsa: 6500 ft. 7 in. O.D. 23 lb. J55, Prime-New T&C casing-$2.43 per ft. 6,000 ft. 10¾ in, 32 lb. slightly used—$1.90 per ft. 5,000 ft. 16 in. O.D. slightly used in gas lines—$3.30 per ft. 11,000 ft. 18 in. O.D. slightly used $2.75 per ft.

11000'—2⅜" OD J-55 EUE Seamless Tubing, #1 Condition. 7000'—4½" OD Grade D Drill Pipe w/Full Hole Shrink Grip Tool Joints, #1 Condition. Beck Equipment Company, P. O. Box 4152, Oklahoma City 9, Oklahoma.

FOR SALE—30,000 ft. New 4½" OD-15.5# PE Tubing. 150,000 ft. 10¾" OD-41.85# No. 1 Grade Used Line Pipe, PE or T&C. Lundquist Pipe & Supply Co. 325 Wright Bldg. Tulsa 3, Oklahoma. Phone LU 5-8850.

BLACK'S OF SCOTLAND—makers of Tents and Sleeping Bags and suppliers of a complete range of rugged Field Equipment serve the leading Oil & Exploration Companies in development projects all over the world. Write for full list. Black's, Greenock, Scotland.

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50,000 ft. 4½" O.D. x .188 wall line pipe in good condition for sale. Will sell in ground or on reconditioned basis f.o.b. Falls City, Nebr. Will lease as installed pipeline on your property.

PIPE RENTAL & SUPPLY CO.
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Box 906 Ph. DAvis 5-8281

4" & 6" LINE PIPE

45,000'—4½" OD, 10.79#, Used No. 1, Lap Weld Line Pipe, 40' Lengths.

35,000'—6½" OD, 18.97#, Used No. 1, Lap Weld Line Pipe, 40' Lengths.

All located in our yard in Central Kansas. This is excellent pipe. It is clean, bevelled and ready to lay.

To see, please contact:
Earl H. Johnson

MOHAWK PETROLEUM COMPANY
Tulsa, Oklahoma.

36" x 70' OVERALL LEBLOND COMBINATION OIL FIELD TURNING THREADING, BORING & TREPANNING LATHE (CAN BE USED AS A 25' CC LATHE).

Built 1941. Used in gov. arsenal only. Excel. condition. 16" hole in spindle, 36" chuck, 6" boring bar, 25' max. cap. Two carriages with tapers. 40-30-7½-5 HP motors. Replacement value $150,000. Terms. 90 day return guarantee.

Very reasonable with or without Boring Equipment.

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Phone Collect—
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FOR SALE EQUIPMENT

NATIONAL T-25 rotary drilling rig with General Motors Twin 6 Diesel Engines, 97 foot Lee C. Moore derrick and 7¼ x 14 Garner Denver Slush Pump, with complete equipment, with or without drill pipe.

FRANKS COMET rotary drilling rig, Model 658-TRD trailer mounted with 84 foot telescoping derrick drawworks, powered by GMC 6-110 Diesel Engines and torque converter, with 7½ x 12 Gardner Denver Slush pump, with or without drill pipe.

36-L BUCYRUS-ERIE Spudder Comb. 1014, Skid Type, equipped with Cummins HI-600 Diesel Engine and Auxiliary A-Frame, with or without tools. VEEDER SUPPLY & DEVELOPMENT CO., Phone 32, or write P. O. Box 201, Cherryvale, Kansas.

KELLY 3½ in. hexagon-$275. 1500 Failing heavy-duty long mast and kelly. Franks 1000—3 drums. Fred E. Butler, Box 481, Pueblo, Colorado.

COMPLETE DRILLING UNIT: Mayhew 1000 with air compressor, water truck, etc. Inventory on request. Walter Duncan, Box 137 Durango, Colorado.

Approximately 6,000' 10-¾" O.D., 32.75# used, lapweld line pipe. About half 20' random lengths and half 40' random lengths.

Price: $1.60 per foot, Tulsa, Oklahoma.

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Tulsa, Oklahoma
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OR
Eskridge Pipe & Supply
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FI 5-2384

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THE OIL AND GAS JOURNAL
P. O. Box 1260 **Tulsa, Okla.**

(Continued from page 161)

Three Oklahoma counties show action

Three counties in widespread Oklahoma areas highlighted exploratory events in that state last week.

A new strike for Kingfisher County is Jones, Shelburne and Pellow Oil Co. 1 Rickey in C NE SE 16-17n-6w, confirmation well to the 1 Shimanek in C NE NE 16-17n-6w. This well flowed 88 bbl. of new oil with acid water in 10 hours from open hole in the Mississippian at 6,818-91 ft. The Manning is a new pay for the area. It was perforated at 6,609-15 ft. Flow was 74 bbl. of oil in 6½ hours on 20/64-in. choke. Flow on 16/64-in. choke was 88 bbl. in 9 hours. Testing continues.

North Dover . . . Another Kingfisher County well is King-Stevenson and Calvert 1 Bradbury in C NW NW 23-18n-7w. The well flowed 34 bbl. per hour on 32/64-in. choke from perforations at 7,104-24 ft.

Beaver County . . . Sinclair Oil & Gas Co. has a dual-zone gas hit in Laverne at 1 Vernon-B Unit in NW SW NE 8-3n-27eCM. The Hoover at 4,412-32 ft. got 12,828 M.c.f.d. plus 12 bbl. condensate per day on 20/64-in. choke. The Tonkawa at 5,386-5,412 and 5,436-50 ft. got 2,924 M.c.f.d.

Caddo County . . . Sinclair has another producer in Caddo County's Northeast Alden pool at 1 German in SE NW 1-6n-13w. It has production from First and Second Bromide sands. Flow was 325 bbl. per day, natural, from 8,826-8,908 and 8,956-89 ft.

More new discoveries

KENTUCKY

Breckinridge County: Ed Goebel-John Smith & Son 15 John Smith, 20-P-35. IP 10 BOPD, Barlow lime 176-181 ft. TD 181 ft. New pay (Barlow) in Balltown pool.

Henderson County: Kennard Oil-Lohmann-Johnson 1 Hallmark, 25-P-26. IP 18 BOPD, Renault lime 2,203-11 ft. TD 2,380 ft. New pay (Renault) and extension to Euterpe pool.

Muhlenberg County: Creek Oil Co. 1 Clell Vincent, 5-I-28. IP 20 BOPD, Jackson 1,728-41 ft. TD 1,746 ft. New pay (Jackson) in New Cypress pool.

Union County: Slagter Producing Co. 1 H. A. Roberts Est., 20-0-21. IP 7 BOPD, Penn. 916-924 ft. TD 2,750 ft. Extension to West Dixie pool.

INDIANA

Gibson County: Jackson & Wrather 1 J. M. Georges, NE SW NW 29-3s-9w. IP 20 BOPD, 20 BWPD, 1,606-17 ft. TD 1,617 ft. Opens West Buckskin field.

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In any role or application, MANI-FLO valves may be hydraulically, electrically or diaphragm controlled and sensed by liquid levels, pressures, temperatures, times or differentials of these.

MANI-FLO valves may be installed in a horizontal line with diaphragms and/or handwheels either vertically or horizontally, or valves may be stacked vertically from ground up with controls pointing in any direction.

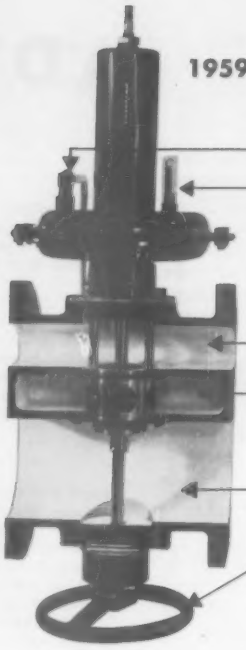
TYPICAL SPECIFICATIONS:

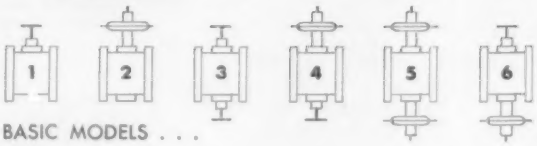
SIZE: 2" screwed inlet — 2" test outlet — 4" flow outlet — ½" sample connection opposite 2" inlet.

WORKING PRESSURE: 600 PSI. Test Pressure 1200 PSI.

MATERIAL: Body and Body Cover Flanges — Ductile Iron. Diaphragm Case — Pressed Steel. Plug, Seat and Cage — Type 303 Stainless Steel. Plug has Buna N synthetic rubber molded to 303 to give some sealing characteristics as "O" ring for tight shut-off. Metal-to-metal contact between plug and seat to prevent extrusion of rubber and to take excess force applied to seat and plug when closed.

1959 Oil Show Exhibit
MODEL 4

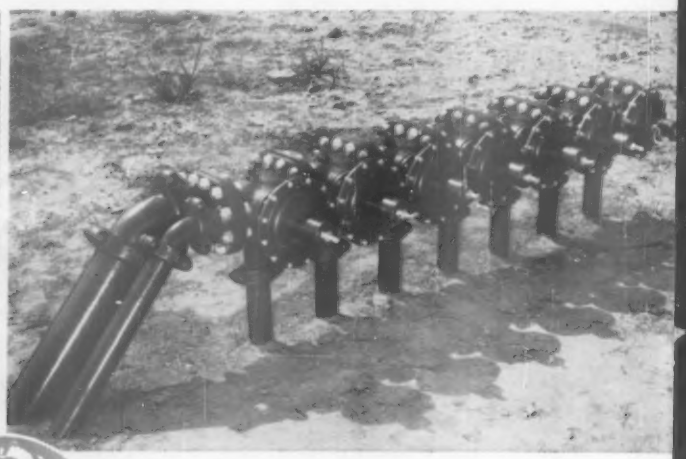

DIAPHRAGM SUPPLY PRESSURE
TRAVEL INDICATOR (UP indicates fluid to flow line . . . test line closed)
UPPER 2" TEST CHAMBER
INLET AND SAMPLE CHAMBER
LOWER 4" FLOW
Hardwheel on Bottom for changing Plug & Seat



BASIC MODELS . . .

FACTS:

- COMPACT . . . less space required for complete manifolds
- EXPANSIBLE . . . add a well — add a MANI-FLO
- VERSATILE . . . for line pressures 600 PSI or less:
  a. May be used as a shut-in valve
  b. Six different models for various applications to choose from
- PRACTICAL . . . travel indicator or positive flag
- SALVABLE . . . bolt it in or un-bolt it
- LONG-LASTING SAFETY . . . ductile iron bodies with stainless trim, tested to 3,000 PSI
- ACCEPTED AND APPROVED . . . hundreds in use already
- LOOKS THE PART . . . Judge for Yourself!



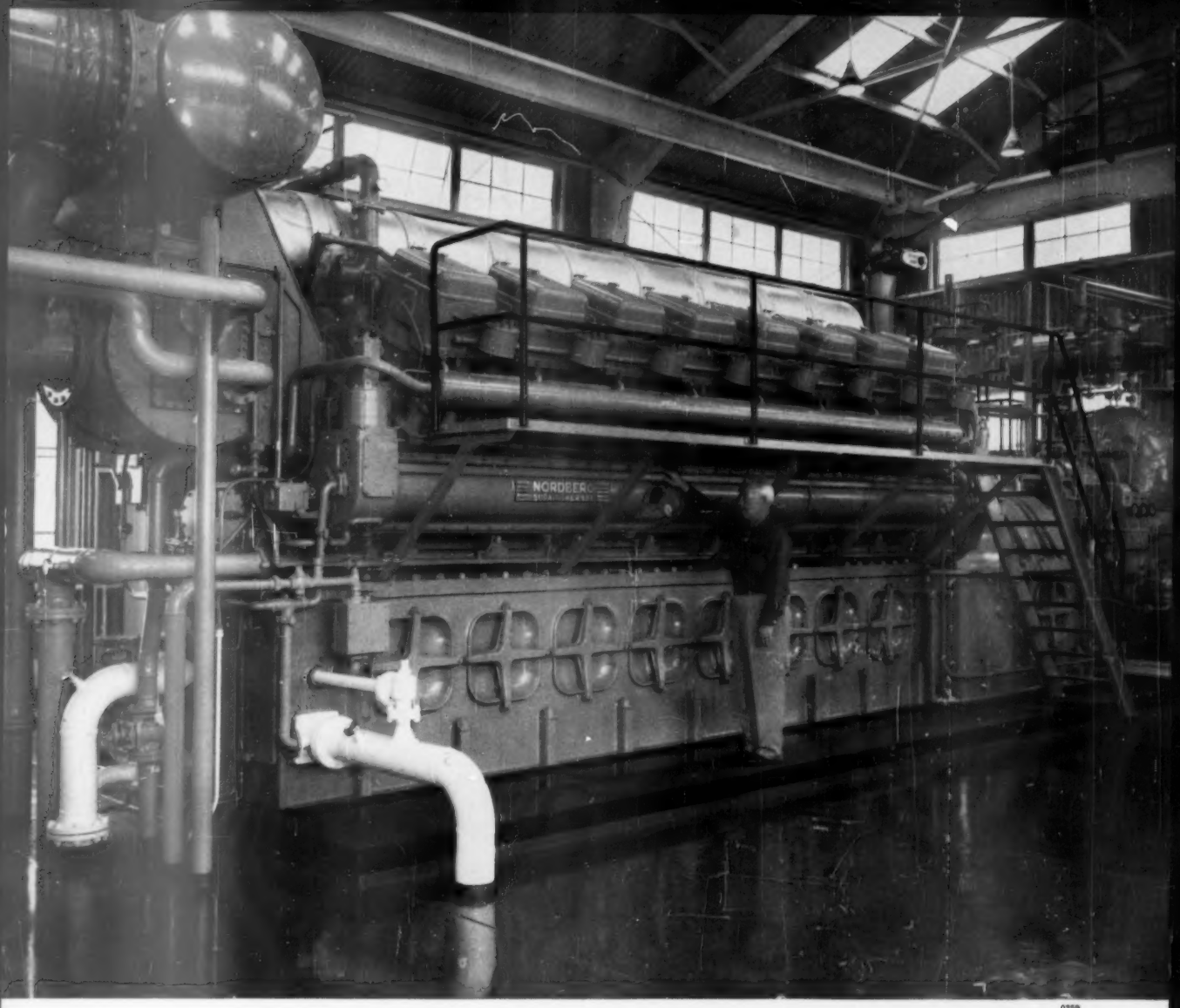
For prices and more information, state model number and quantity. Address . . .

It's a National®

NATIONAL TANK COMPANY

DRAWER 1710

TULSA, OKLAHOMA



0359

Pipe line engines by Nordberg

One of four Nordberg *Supairthermal*® spark-ignition gas engine-gear sets driving centrifugal compressors in Transcontinental Gas Pipe Line Corporation's Station No. 23.

NORDBERG MANUFACTURING COMPANY
MILWAUKEE 1, WISCONSIN

NORDBERG MACHINERY

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Hughes ENGINEERED BIT PROGRAMS are cutting hole time... lowering bit costs

Many operators are already familiar with and are benefiting from this special service – the *Hughes Engineered Bit Program.*

Where Hughes bit programs are being followed, some spectacular results are being achieved.

In developing a Hughes program for a given well or wells, our representative works with the operator in determining the types of bits to be used – from top to bottom, drilling weights for each bit, rotary speeds and hydraulics. These recommendations are based on the most complete performance data available... and on the industry's most extensive rock bit experience.

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HUGHES TOOL COMPANY

50TH ANNIVERSARY YEAR 1909 – 1959